FORM PTO-1390 (REV 5-29-99) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

# TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: 503.39781X00 filed 03/20/01

U.S. APPLICATION NO. (If known, see 37 CFR 1.5): 09/787555

| INTERNATIONAL APPLICATION NO. | INTERNATIONAL FILING DATE | PRIORITY DATE CLAIMED |
|---|---|---|
| PCT/JP99/07042 | 15 December 1999 (15.12.99) | |

TITLE OF INVENTION: GATEWAY AND DISTRIBUTED SYSTEM USING THE GATEWAY

APPLICANT(S) FOR DO/EO/US: YOKOYAMA, TAKANORI and NAGAURA, WATARU

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [ ] This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. [X] A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [ ] is transmitted herewith (required only if not transmitted by the International Bureau).
   b. [X] has been transmitted by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [X] A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. [ ] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are transmitted herewith (required only if not transmitted by the International Bureau).
   b. [ ] have been transmitted by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.
8. [ ] A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. [X] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

**Items 11. to 16. below concern document(s) or information included:**

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [X] A FIRST preliminary amendment.
    [ ] A SECOND or SUBSEQUENT preliminary amendment.
14. [ ] A substitute specification.
15. [X] A change of power of attorney and/or address letter.
16. [X] Other items or information:

PCT Request Form
List and Copies of Prior Art Refs.
International Search Report
Proposed Drawing Corrections
Figs. 1-7

532 Rec'd PCT/PTO 20 MAR 2001

| U.S. APPLICATION NO. (if known, see 37 CFR 1.5) | INTERNATIONAL APPLICATION NO. | ATTORNEY'S DOCKET NUMBER |
|---|---|---|
| 09/787555 | PCT/JP99/07042 | 503.39781X00 |

17. [X] The following fees are submitted:

| BASIC NATIONAL FEE ( 37 CFR 1.492 (a) (1) - (5) ) : | CALCULATIONS PTO USE ONLY |
|---|---|
| Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... **$970.00** | |
| International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... **$840.00** | |
| International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... **$690.00** | |
| International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... **$670.00** | |
| International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) ..... **$96.00** | |
| **ENTER APPROPRIATE BASIC FEE AMOUNT =** | $ 860.00 |
| Surcharge of **$130.00** for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(e)). | $ 0.00 |

| CLAIMS | NUMBER FILED | NUMBER EXTRA | RATE | |
|---|---|---|---|---|
| Total claims | 6 - 20 = | 0 | X **$18.00** | $ 0.00 |
| Independent claims | 4 - 3 = | 1 | X **$78.00** | $ 80.00 |
| MULTIPLE DEPENDENT CLAIM(S) (if applicable) | | | + **$260.00** | $ 0.00 |
| **TOTAL OF ABOVE CALCULATIONS =** | | | | $ 940.00 |
| Reduction of 1/2 for filing by small entity, if applicable. A Small Entity Statement must also by filed (Note 37 CFR 1.9, 1.27, 1.28). | | | | $ 0.00 |
| **SUBTOTAL =** | | | | $ 940.00 |
| Processing fee of **$130.00** for furnishing the English translation later than [ ]20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f)). + | | | | $ 0.00 |
| **TOTAL NATIONAL FEE =** | | | | $ 940.00 |
| Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property + | | | | $ 40.00 |
| **TOTAL FEES ENCLOSED =** | | | | $ 980.00 |
| | | | | **Amount to be refunded:** $ |
| | | | | **charged:** $ |

a. [X] A check in the amount of $ 980.00 to cover the above fees is enclosed.

b. [ ] Please charge my Deposit Account No. _____ in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 01-2135. A duplicate copy of this sheet is enclosed.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO:

Carl I. Brundidge
Antonelli,Terry,Stout & Kraus, LLP
1300 North Seventeenth Street
Suite 1800
Arlington, VA 22209

SIGNATURE:

Carl I. Brundidge
NAME

29,621
REGISTRATION NUMBER

503.39781X00

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant(s): YOKOYAMA et al

Serial No.: 09/787,555

Filed: March 20, 2001

For: Gateway And Distributed System Using The Gateway

Group:

Examiner:

PROPOSED AMENDMENTS TO THE DRAWINGS

Assistant Commissioner for Patents
Washington, DC 20231

September 25, 2001

Sir:

It is proposed that the drawings in the above-identified application be amended in accordance with the attached red-lined prints, and approval of these drawing corrections is respectfully requested at this time.

Upon receipt of the approval of the amendments to the drawings and receipt of the official Notice of Allowance, the drawing amendments will be effected.

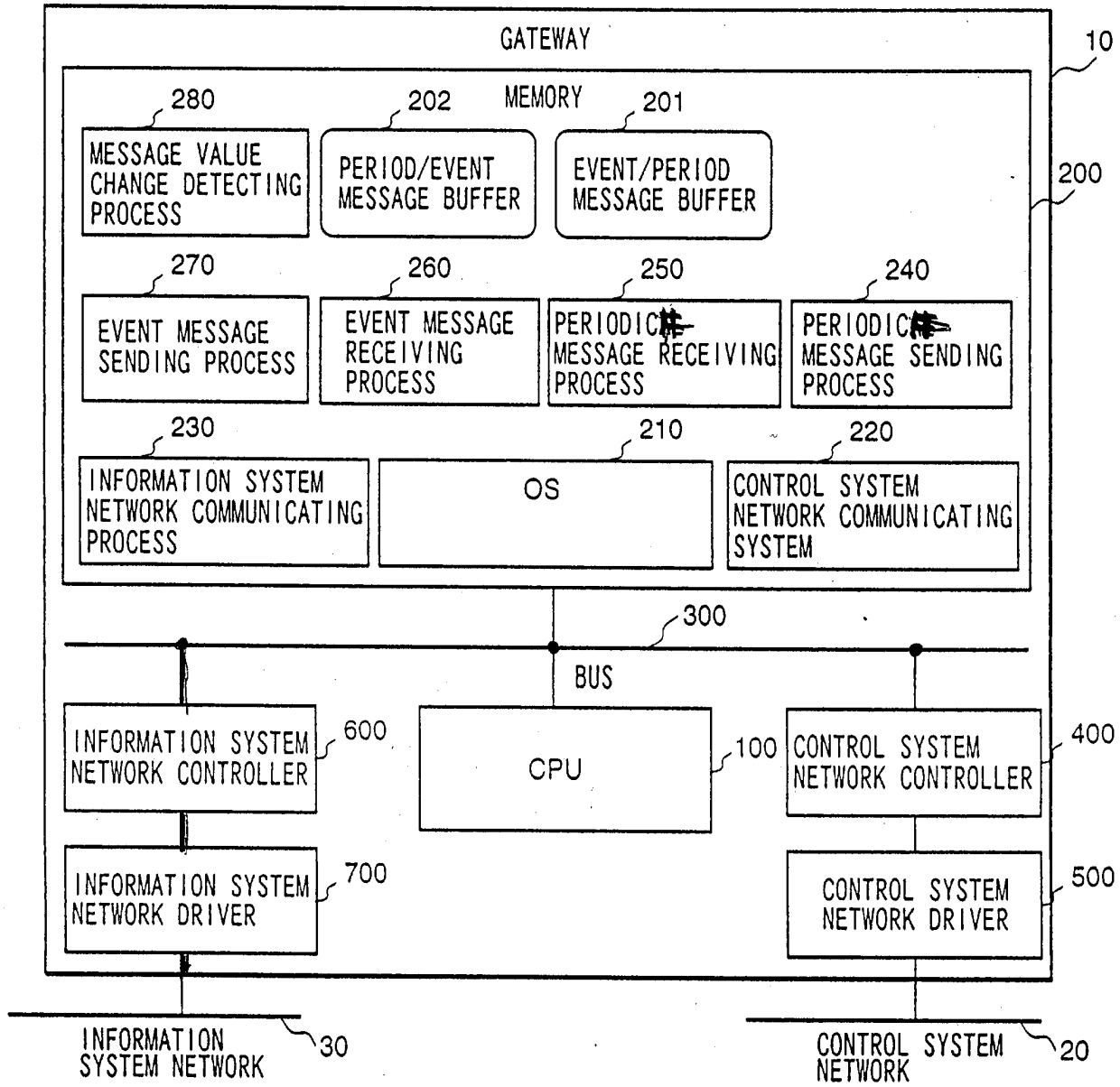
Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

Alan E. Schiavelli
Registration No. 32,087

DRA/AES/jla
(703) 312-6600
Attachments

FIG. 1


GATEWAY
10
MEMORY
280
MESSAGE VALUE CHANGE DETECTING PROCESS
202
PERIOD/EVENT MESSAGE BUFFER
201
EVENT/PERIOD MESSAGE BUFFER
200
270
EVENT MESSAGE SENDING PROCESS
260
EVENT MESSAGE RECEIVING PROCESS
250
PERIODIC MESSAGE RECEIVING PROCESS
240
PERIODIC MESSAGE SENDING PROCESS
230
INFORMATION SYSTEM NETWORK COMMUNICATING PROCESS
210
OS
220
CONTROL SYSTEM NETWORK COMMUNICATING SYSTEM
300
BUS
INFORMATION SYSTEM NETWORK CONTROLLER
600
CPU
100
CONTROL SYSTEM NETWORK CONTROLLER
400
INFORMATION SYSTEM NETWORK DRIVER
700
CONTROL SYSTEM NETWORK DRIVER
500
INFORMATION SYSTEM NETWORK
30
CONTROL SYSTEM NETWORK
20

1/4

FIG. 2

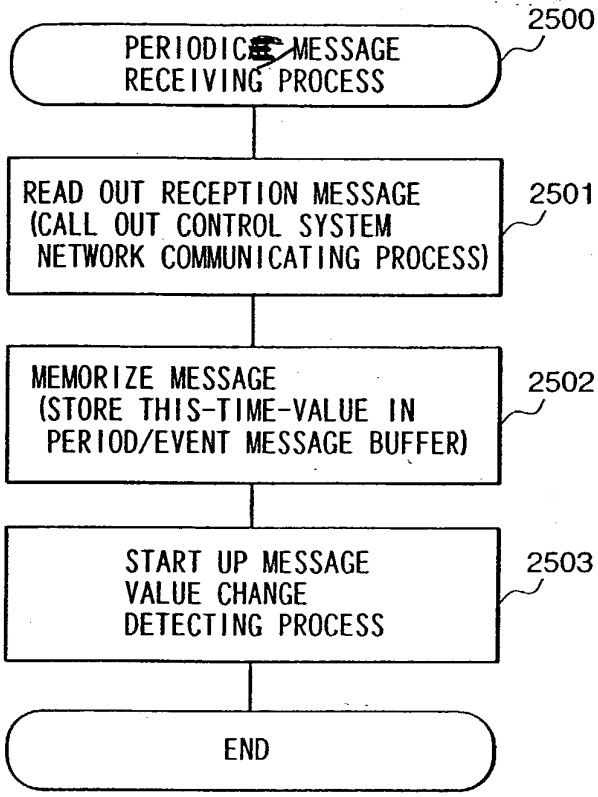
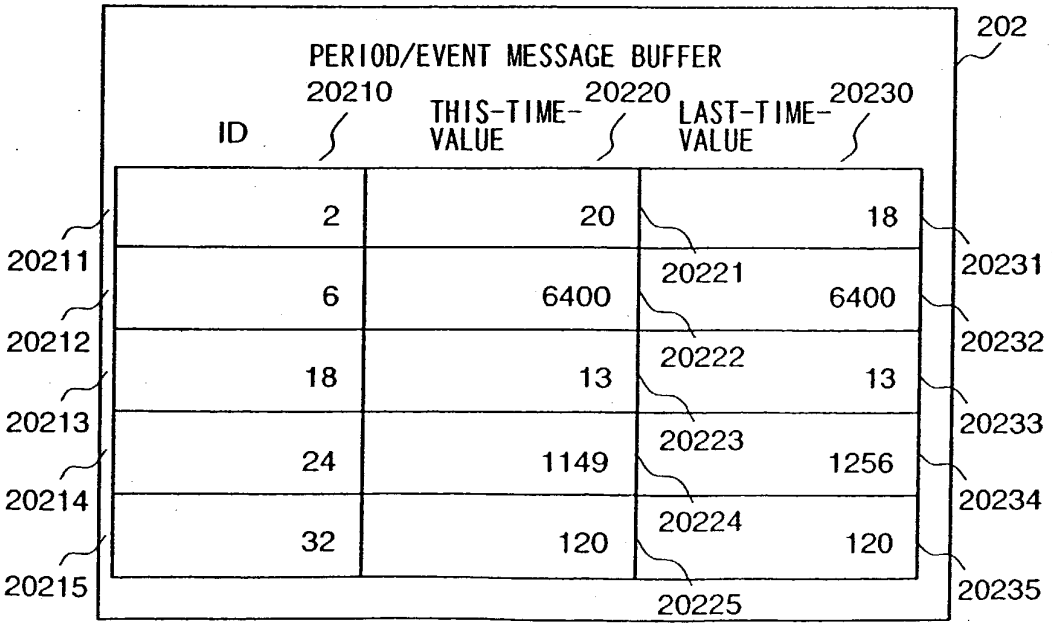

PERIODIC MESSAGE RECEIVING PROCESS
2500
READ OUT RECEPTION MESSAGE (CALL OUT CONTROL SYSTEM NETWORK COMMUNICATING PROCESS)
2501
MEMORIZE MESSAGE (STORE THIS-TIME-VALUE IN PERIOD/EVENT MESSAGE BUFFER)
2502
START UP MESSAGE VALUE CHANGE DETECTING PROCESS
2503
END

FIG. 3


202
PERIOD/EVENT MESSAGE BUFFER
ID
20210
THIS-TIME-VALUE
20220
LAST-TIME-VALUE
20230
2
20
18
20211
20231
6
6400
20221
6400
20212
20232
18
13
20222
13
20213
20233
24
1149
20223
1256
20214
20234
32
120
20224
120
20215
20235
20225


503.39781X00

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant(s): YOKOYAMA et al

Serial No.: 09/787,555

Filed: March 20, 2001

For: Gateway And Distributed System Using The Gateway

Group:

Examiner:

**SECOND PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents
Washington, D.C. 20231

September 25, 2001

Sir:

The following preliminary amendments and remarks are respectfully submitted in connection with the above-identified application.

**IN THE SPECIFICATION:**

Please replace the original specification with the attached Substitute Specification.

**IN THE ABSTRACT OF THE DISCLOSURE:**

Please replace the original abstract with the attached abstract.

ABSTRACT

A gateway by which a network for performing communication periodically and a network for performing communication to an event can be effectively connected and a distributed system are provided. The gateway connecting different networks receives a periodic message, and when a change of the received message is detected, it sends he message as an event message and delivers the message periodically.

## REMARKS

The specification has been amended to correct errors of a typographical and grammatical nature. Due to the number of corrections thereto, applicants submit herewith a Substitute Specification, along with a marked-up copy of the original specification for the Examiner's convenience. The substitute specification includes the changes as shown in the marked-up copy and includes no new matter. Therefore, entry of the Substitute Specification is respectfully requested.

The abstract has also been amended to more clearly describe the features of the present invention.

Also submitted herewith is a proposed amendment to the drawings, wherein Figs. 1 and 2 have been amended at this time. Upon receipt of the approval of the amendment to the drawings and receipt of a Notice of Allowance, the proposed drawing corrections will be effected in accordance with present practice.

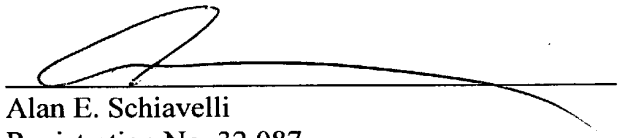
Entry of the preliminary amendments and examination of the application is respectfully requested.

To the extent necessary, applicant's petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (503.39781X00) and please credit any

excess fees to such deposit account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP



Alan E. Schiavelli
Registration No. 32,087

DRA/AES/jla
(703) 312-6600

REWRITTEN MARKED UP COPY

ABSTRACT

A gateway by which a network for performing communication periodically and a network for performing communication to an event ~~driven~~ can be effectively connected and a distributed system are provided. The gateway connecting different networks receives a ~~periodical~~ periodic message, and when a change of the received message is detected, it sends ~~it~~ the message as an event message~~,~~ and delivers the message periodically.

503.39781X00

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicants: T. YOKOYAMA, et al

Serial No.: Not yet assigned

Filed: March 20, 2001

For: GATEWAY AND DISTRIBUTED SYSTEM USING THE GATEWAY

Group: Not yet assigned

Examiner: Not yet assigned

**PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents
Washington, D.C. 20231

March 20, 2001

Sir:

The following amendments and remarks are respectfully submitted prior to the Rule 53(b) Continuation Application filed on even date.

**IN THE DRAWINGS**

Please correct the drawings as set forth in the Proposed Drawing Corrections filed on even date so as to connect Figs. 1-7 and to add Figs. 8-12.

**REMARKS**

The present Preliminary Amendment and Proposed Drawing Corrections filed on even date proposes to amend the drawings which formed a part of the International application to

include Figs. 8-12. Each of Figs. 8-12 is referred in the "Brief Explanation of the Drawings" section and discussed in the detail throughout the "Best Mode for Embodying the Invention" section of the International application and the present application which is an English language translation thereof.

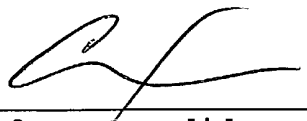
It should be noted that the contents of Figs. 8-12 are merely explanatory of the invention graphically disclosed in Figs. 1-7 and described in the International application. Thus, the contents of Figs. 8-12 do not add any new matter to the present application since the description of the contents of Figs. 8-12 was already contained in the International application.

Therefore, entry of the present Preliminary Amendment and Proposed Drawing Corrections is respectfully requested.

Please charge any shortage in fees due in connection with the filing of this paper, or credit any overpayment of fees, to the deposit account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (503.39781X00).

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP



Carl I. Brundidge
Registration No. 29,621

CIB/jdc
(703) 312-6600

503.39781X00

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicants: T. YOKOYAMA, et al

Serial No.: Not yet assigned

Filed: March 20, 2001

For: GATEWAY AND DISTRIBUTED SYSTEM USING THE GATEWAY

Group: Not yet assigned

Examiner: Not yet assigned

**PROPOSED DRAWING CORRECTIONS**

Assistant Commissioner
for Patents
Washington D.C. 20231

March 20, 2001

Sir:

It is proposed that the drawings in the above-identified application be amended in accordance with the attached red-lined prints. Approval of the same is respectfully requested at this time.

Upon receipt of the official Notice of Allowance, the drawings will be corrected in accordance with the procedure established therefor.

Respectfully submitted,

CIB/jdc
Attachments
703/312-6600

Carl I. Brundidge
Registration No: 29,621
ANTONELLI, TERRY, STOUT & KRAUS, LLP

FIG. 1

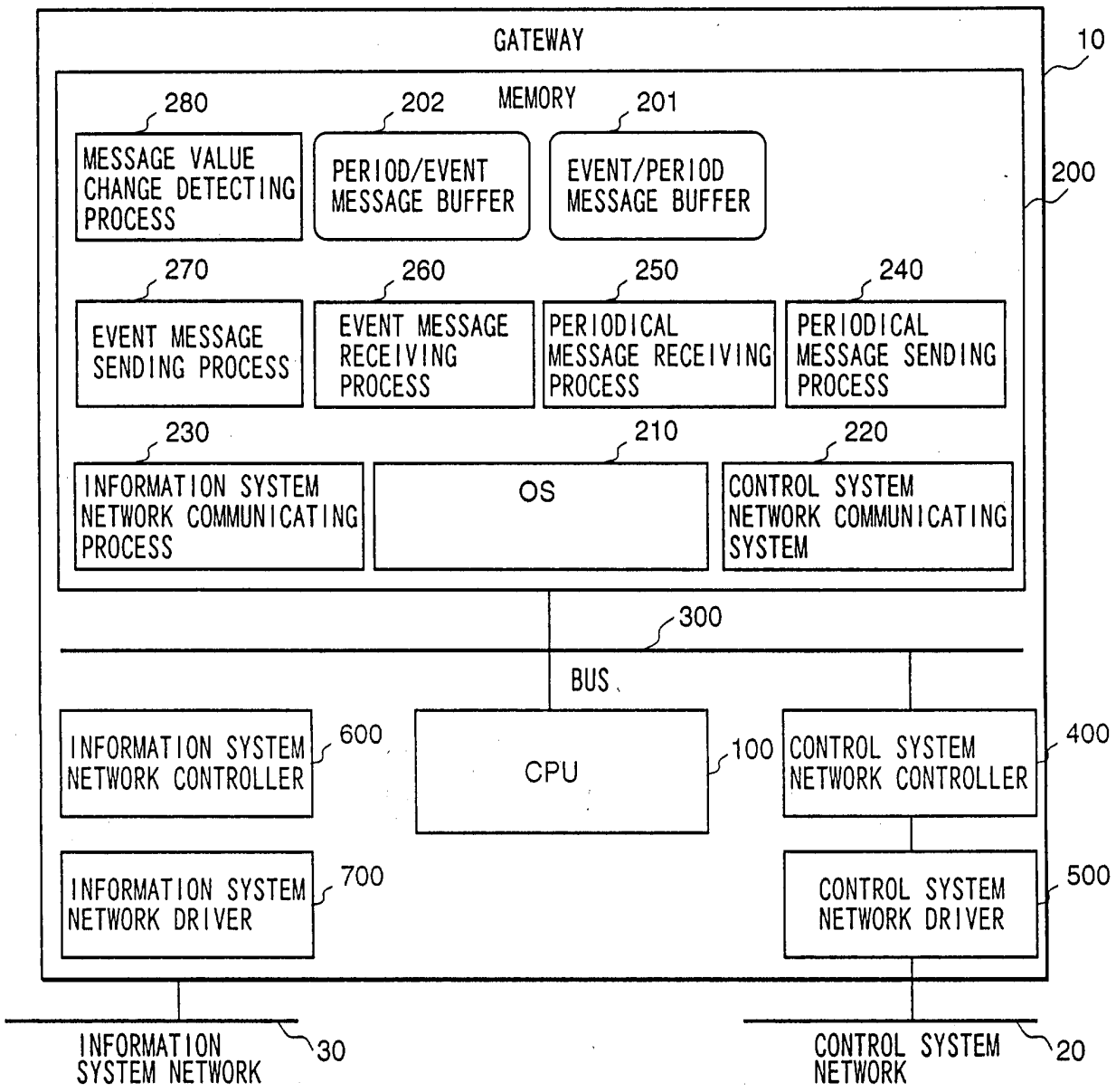


FIG. 2

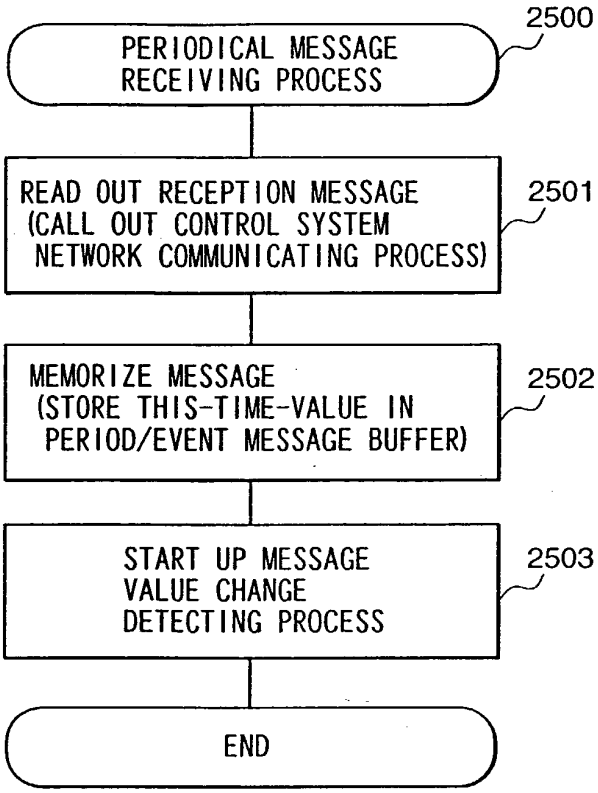

PERIODICAL MESSAGE RECEIVING PROCESS
2500
READ OUT RECEPTION MESSAGE (CALL OUT CONTROL SYSTEM NETWORK COMMUNICATING PROCESS)
2501
MEMORIZE MESSAGE (STORE THIS-TIME-VALUE IN PERIOD/EVENT MESSAGE BUFFER)
2502
START UP MESSAGE VALUE CHANGE DETECTING PROCESS
2503
END

FIG. 3

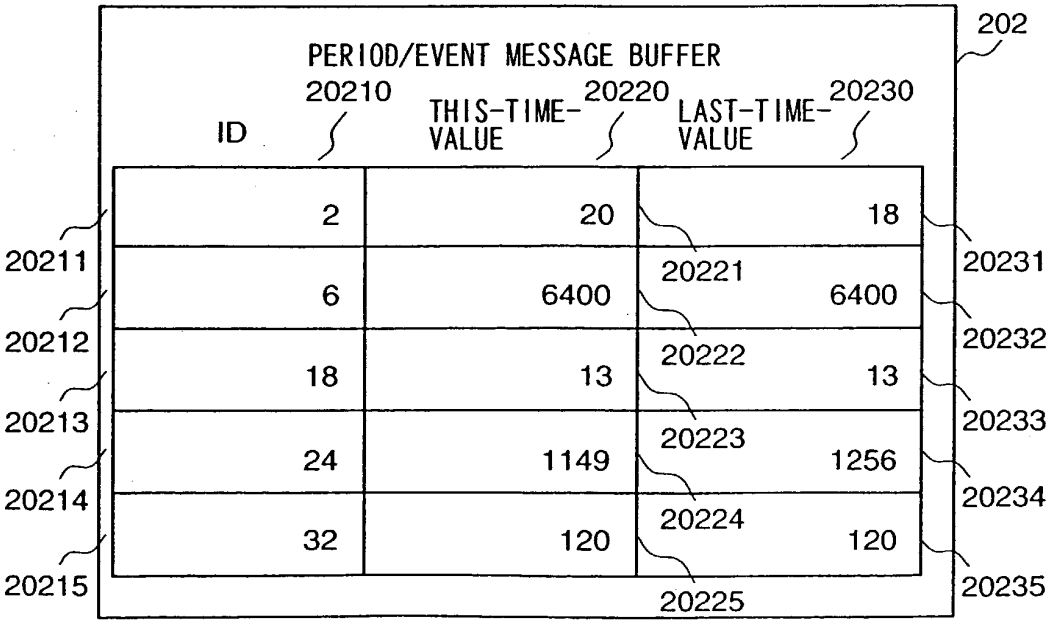

202
PERIOD/EVENT MESSAGE BUFFER
ID
20210
THIS-TIME-VALUE
20220
LAST-TIME-VALUE
20230
2
20
18
20211
20231
6
6400
20221
6400
20212
20232
18
13
20222
13
20213
20233
24
1149
20223
1256
20214
20234
32
120
20224
120
20215
20235
20225

FIG. 4

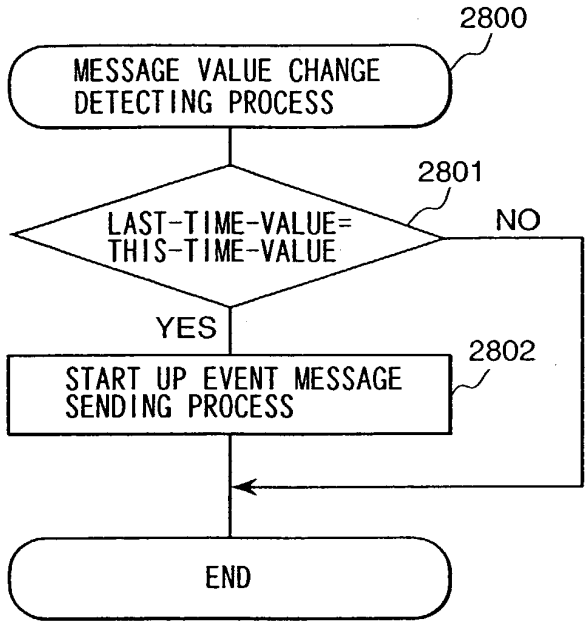

2800
MESSAGE VALUE CHANGE DETECTING PROCESS
2801
LAST-TIME-VALUE= THIS-TIME-VALUE
NO
YES
2802
START UP EVENT MESSAGE SENDING PROCESS
END

FIG. 5

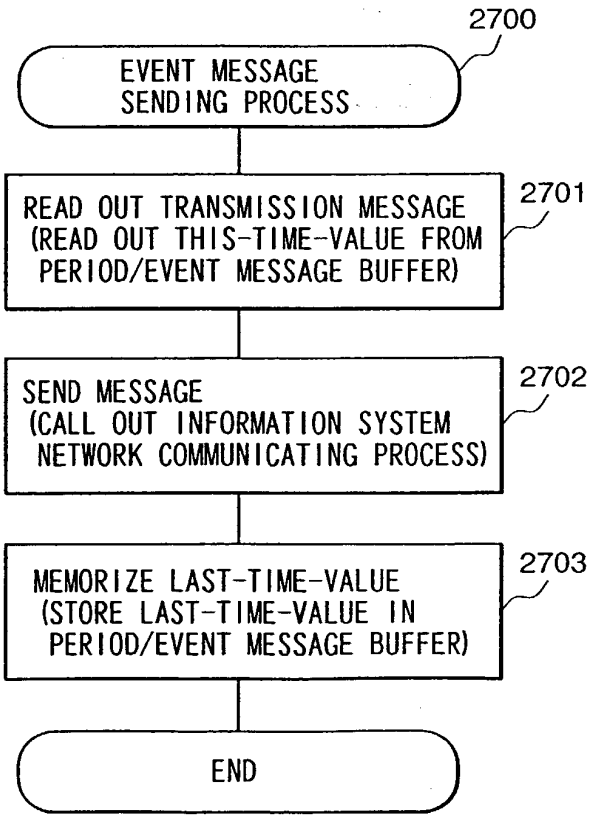

2700
EVENT MESSAGE SENDING PROCESS
READ OUT TRANSMISSION MESSAGE (READ OUT THIS-TIME-VALUE FROM PERIOD/EVENT MESSAGE BUFFER)
2701
SEND MESSAGE (CALL OUT INFORMATION SYSTEM NETWORK COMMUNICATING PROCESS)
2702
MEMORIZE LAST-TIME-VALUE (STORE LAST-TIME-VALUE IN PERIOD/EVENT MESSAGE BUFFER)
2703
END

FIG. 6

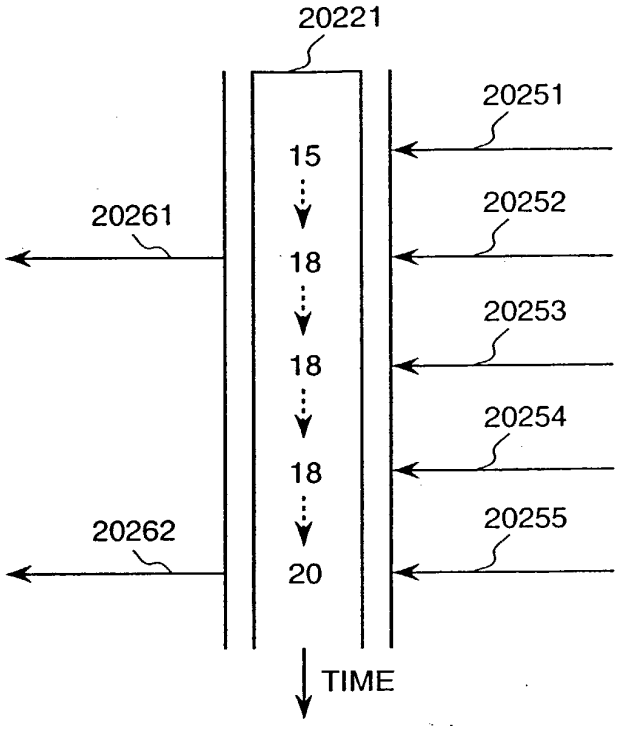

20221
20251
15
20261
20252
18
20253
18
20254
18
20262
20255
20
TIME

FIG. 7

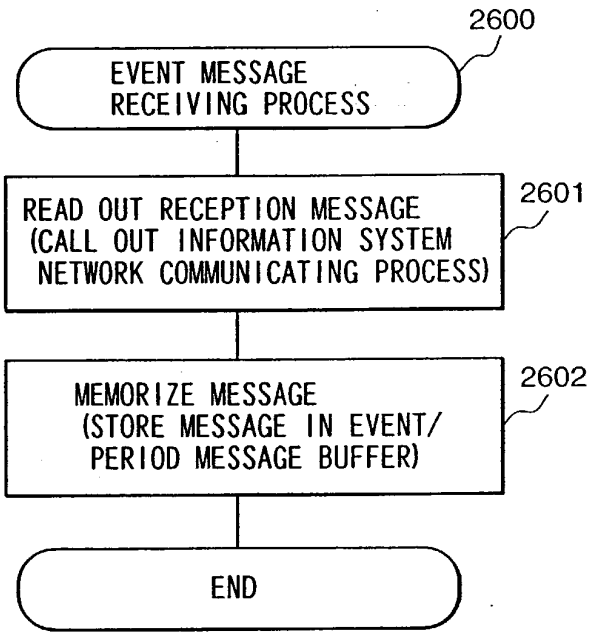

2600
EVENT MESSAGE RECEIVING PROCESS
READ OUT RECEPTION MESSAGE (CALL OUT INFORMATION SYSTEM NETWORK COMMUNICATING PROCESS)
2601
MEMORIZE MESSAGE (STORE MESSAGE IN EVENT/ PERIOD MESSAGE BUFFER)
2602
END

FIG. 8

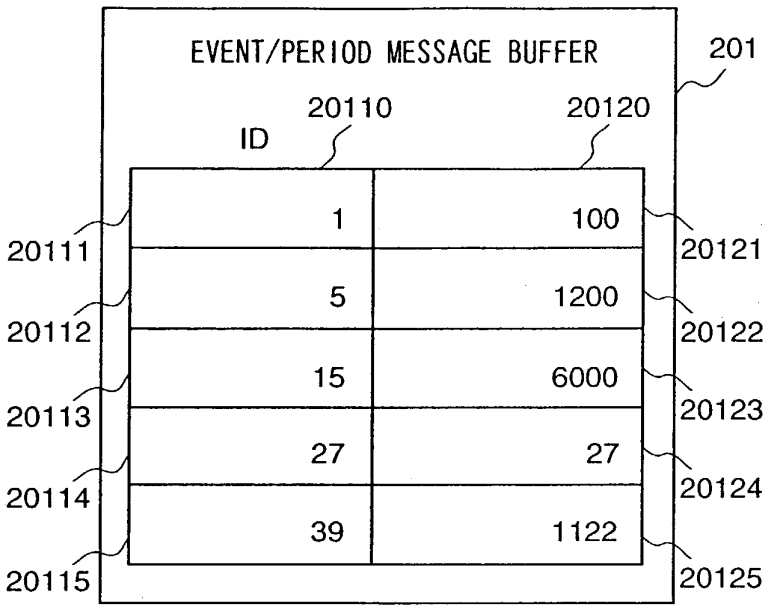

EVENT/PERIOD MESSAGE BUFFER
201
ID
20110
20120
1
100
5
1200
15
6000
27
27
39
1122
20111
20112
20113
20114
20115
20121
20122
20123
20124
20125

FIG. 9

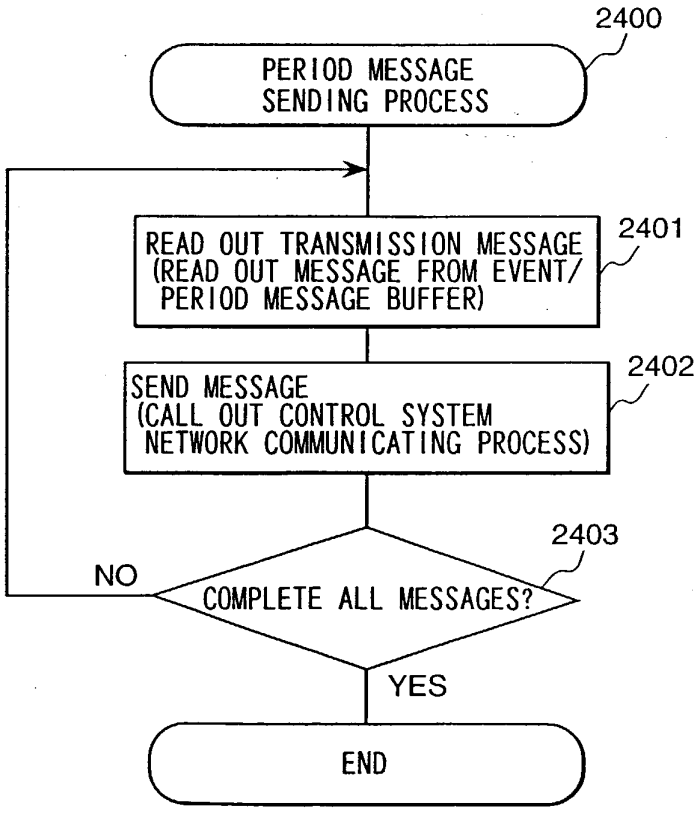

2400
PERIOD MESSAGE SENDING PROCESS
READ OUT TRANSMISSION MESSAGE (READ OUT MESSAGE FROM EVENT/ PERIOD MESSAGE BUFFER)
2401
SEND MESSAGE (CALL OUT CONTROL SYSTEM NETWORK COMMUNICATING PROCESS)
2402
COMPLETE ALL MESSAGES?
2403
NO
YES
END

FIG. 10

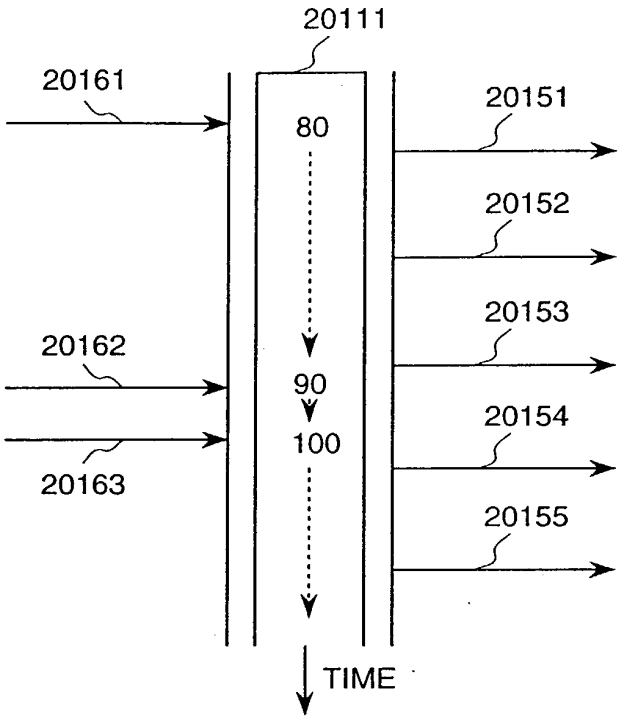
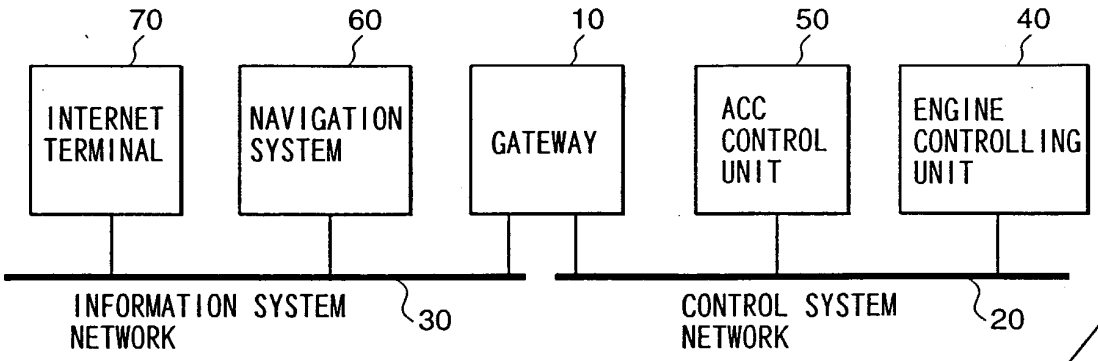
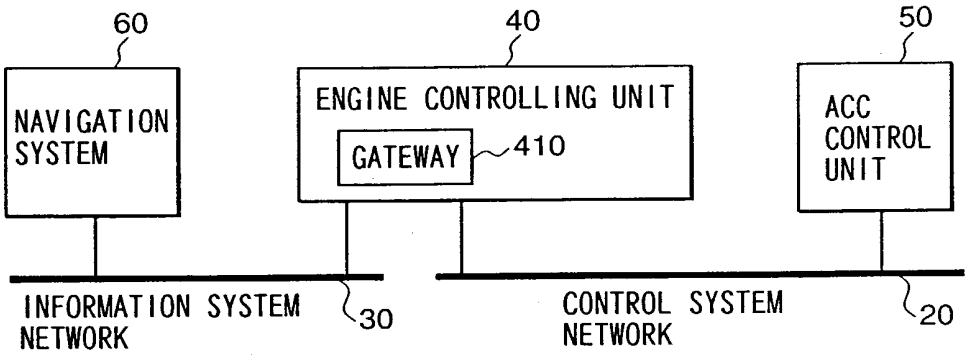

20111
20161
80
20151
20152
20153
20162
90
100
20154
20163
20155
TIME

FIG. 11


70
60
10
50
40
INTERNET TERMINAL
NAVIGATION SYSTEM
GATEWAY
ACC CONTROL UNIT
ENGINE CONTROLLING UNIT
INFORMATION SYSTEM NETWORK
30
CONTROL SYSTEM NETWORK
20

7/7

FIG. 12


60
NAVIGATION SYSTEM
40
ENGINE CONTROLLING UNIT
GATEWAY
410
50
ACC CONTROL UNIT
INFORMATION SYSTEM NETWORK
30
CONTROL SYSTEM NETWORK
20

SUBSTITUTE SPECIFICATION

# GATEWAY AND DISTRIBUTED SYSTEM USING THE GATEWAY

## TECHNICAL FIELD

[0001] This invention relates to a gateway for connecting a plurality of networks having different characteristics, and a distributed system using this gateway.

## BACKGROUND OF THE INVENTION

[0002] In the recent development of the automobile, various electronic apparatuses have been loaded on the automobile, including audio instruments, a navigation device, an engine controlling device, a driving device for a mission, for example, and these electronic apparatuses are connected to different networks depending upon their characteristics. To a network for an information system, there is connected an apparatus operating in response to an input (input of an event) from the outside, such as the output of an audio instrument; and, to a network for a control system, there is connected an apparatus for outputting information at a predetermined period, such as an engine controlling apparatus.

[0003] Japanese Patent Application Laid-Open No.11-8647(1999) discloses a gateway for use in connecting plural LANs which have different protocols. However, in such prior art publication, there is no description of a gateway connecting networks which are different in character, such as a so-called information system network and a so-called control system network for example. Specifically, there is no disclosure in the above-mentioned publication of the transmission of information between an information system network in which information is transmitted in response

to an event and a control system network in which information is transmitted at a constant period.

SUMMARY OF THE INVENTION

[0004] An object of this invention is to provide a gateway which can connect an information system network and a control system network and can carry out the exchange of information between the information system network and the control system network, and to provide a distributed system using this gateway.

[0005] Characteristic features of this invention for obtaining the above-mentioned object are as follows. The object of this invention can be achieved by an individual or any combination of these characteristic features.

[0006] The gateway operates to send and receive a message which is transmitted periodically, as well as to send and receive a message which is transmitted in response to an event, or a request or demand.

[0007] Also, the gateway, upon the detection of a change in a periodic message received from one network, sends a message to another network.

[0008] Also, the gateway periodically sends a message received from one network to another network.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Fig. 1 is a block diagram showing the construction of a gateway according to one embodiment of this invention;

[0010] Fig. 2 is a flow chart showing a periodic message receiving process according to one embodiment of this invention;

[0011] Fig. 3 is a diagram showing the construction of a period/event message buffer according to one embodiment of this invention;

[0012] Fig. 4 is a flow chart showing a message value change detecting process according to one embodiment of this invention;

[0013] Fig. 5 is a flow chart showing an event message sending process according to one embodiment of this invention;

[0014] Fig. 6 is a diagram showing one example of the operation in a message transfer from a control system network to an information system network according to one embodiment of this invention;

[0015] Fig. 7 is a flow chart showing the flow of an event message receiving process according to one embodiment of this invention;

[0016] Fig. 8 is a diagram showing the construction of an event/period message buffer according to one embodiment of this invention;

[0017] Fig. 9 is a flow chart showing a periodic message sending process according to one embodiment of this invention;

[0018] Fig. 10 is a diagram showing one example of the operation in a message transfer from an information system network to a control system network according to one embodiment of this invention;

[0019] Fig. 11 is a block diagram showing the construction of a distributed system according to one embodiment of this invention;

[0020] Fig. 12 is a block diagram showing the construction of a distributed system according to another embodiment of this invention.

BEST MODE FOR EMBODYING THE INVENTION

[0021] Hereinafter, various embodiments of this invention will be described in detail with reference to the drawings.

[0022] A first embodiment of this invention will be explained with

reference to Fig. 1. This embodiment is intended to handle an event message mode, in which a message is output from a processing apparatus onto a network in response to the generation of an event, and a periodic message mode, in which a message is output from the processing apparatus onto a network at a predetermined period. It enables the exchange of messages between a network to which the processing apparatus which outputs the event message is connected (hereinafter, "an information system network" is referred to) and a network to which the processing apparatus which outputs the periodic message is connected (hereinafter, "a control system network" is referred to).

[0023] Fig. 1 shows the construction of a gateway according to this embodiment of the invention. The gateway l0 is connected to the control system network 20 and the information system network 30. A CAN (Controller Area Network) is used for the control system network 20 and information system network 30 according to this embodiment. The gateway 10 is comprised of a CPU 100, a memory 200, a bus 306, a control system network controller 400, a control system network driver 500, an information system network controller 600 and an information system network driver 700.

[0024] The CPU 100, the memory 200, the control system network controller 400, and the information system network controller 600 are connected to the bus 300, which operates as a signal line. The CPU 100 reads out a program stored in the memory 200 and controls the control system network controller 400, the control system network driver 500, the information system network controller 600 and the information system network driver 700, so that the exchange of a messages is performed between the information system network 20 and the control system network 30.

[0025] The control system network controller 400 is connected to the

control system network driver 500, and the control system network driver 500 is connected to the control system network 20, so that message transmission to the control system network 20 is carried out. The information system network controller 600 is connected to the information system network driver 700, and the information system network driver 700 is connected to the information system network 30, so that message transmission to the information system network 30 is carried out.

[0026] The memory 200 has a program stored therein for running an OS (Operating System) and application programs stored therein for a control system network communicating process 220, an information system network communicating process 230, a periodic message sending process 240, a periodic message receiving process250, an event message receiving process 260, an event message sending process 270 and a message value change detecting process 280; and, the memory 200 also has data storing areas, such as an event/period message buffer 201 and a period/event message buffer 202.

[0027] As the OS 210 in this embodiment, the OSEK-OS described in OSEK /VDX Operating System Version 2.0 revision 1 (1997) published by OSEK/VDX is utilized. Thus, by using this OS, it is possible to cause the application programs to start up periodically as tasks, and a message on the network to start up in response to a received event.

[0028] Also, as the control system network communicating process 220, the OSEK-COM described in OSEK/VDX Communication Version 2.1 revision 1 (1998) published by OSEK/VDX is utilized. The OSEX-COM operates to perform both message sending and message receiving. Also, it has a function of specifying a message for reception in accordance with an ID attached thereto. Therefore, it is possible to

specify a message to be received among periodic messages on the control system network 20.

[0029] In a case where a message is transmitted to the control system network 20, by calling out Send Message ( ), which is one API Service of the OSEK-COM from the application program for performing the periodic message sending process, it is possible to transmit the message onto the control system network 20 through the control system network controller 400. Also, in receiving a message from the control system network 20, the predetermined ID of the message to be received is managed, and when messages having the same ID are received, the control system network controller 400 performs a reception interrupt. In response, to the reception interrupt from the control system network controller 400, an interrupt process for the message reception processing of the control system network communicating process is started up, and it becomes possible to take the message on the control system network 20. The message fetched in can be read out by calling out Receive Message ( ), which is one of the API Services of the OSEK-COM.

[0030] In this embodiment, the information system network communicating process 230 also uses the OSEK-COM. Therefore, also in a case where a message is sent to the information system network 30, an application program for performing the transmission process of the event message is executed by calling out therefrom Send Message ( ), which is one of the API Services of the OSEK-COM, whereby the message can be sent onto the information system network 30 through the information system network controller 600. Also, in receiving a message from the information system network 30, the predetermined ID of the message to be retrieved is managed, and when messages having the same ID are received, the information system

network controller 600 performs a reception interrupt. In response to the reception interrupt from the information system network controller 600, an interrupt process for the message reception of the information system network communicating process is started up, and it becomes possible to take the message on the information system network 30. The message fetched in can be read out by calling out Receive Message ( ), which is one of the API Services of the OSEK-COM.

[0031] Next, the operation of the gateway 10 according to this embodiment .will be explained. First, the case where a message is transferred from the control system network 20, which handles periodic messages, to the information system network30, which handles the event messages, will be explained.

[0032] As stated above, when the control system network controller 400 receives a message having a predetermined ID from among a plurality of periodic messages on the control system network, it will perform an interruption. In response thereto, the OS 210 starts up the program of the periodic message receiving process 250. This program of the periodic message receiving process 250 is executed as one task. Since the control system network 20 will transmit messages periodically, this process (task) is also started up periodically.

[0033] The processing flow of a periodic message receiving Process 2500, which is part of the periodic message receiving process 250, will be explained with reference to Fig. 2. First, the periodic message receiving Process 2500 reads out a received message which was taken from the control system network 20 (Process 2501). This is executed by calling out Receive Message of the control system network communicating process 220, as mentioned above.

[0034] Next, the message read out is stored in the period/event message

buffer 202 (Process 2502). Now, the construction of the period/event message buffer 202 will be explained with reference to Fig. 3. As explained above, a message has an ID (identifier) attached thereto. The period/event message buffer 202 includes a message ID storing area 2021l0, a this-time-value (value of the most recent message) storing area 20220 and a last-time-value (value of the message received most previously after the most recent message) storing area 20230. Further, these areas are divided into storing areas per ID. That is, the ID storing area 20210 comprises an area 20211, an area 20212, an area 20213, etc. The this-time-value storing area 20220 comprises an area 20221, an area 20222, an area 20223, etc. per respective ID. The last-time-value storing area 20230 also comprises an area 20231, an area 20232, an area 20233, etc. per ID. For example, the message of ID2 is stored so that the value (2) of its ID is memorized in the area 20211, the this-time-value (20) is memorized in the area 20221 and the last-time-value (18) is memorized in the area 20231.

[0035] In Process 2502, the value of the message read out is stored in the storing area of the this-time-value corresponding to the ID of this message. For example, in the case of the message of which is ID is 2, the value of the message read out is stored in the area 20221. In the case of the message having an ID of 6, the value of the message read out is stored in the area 20222.

[0036] Lastly, a message value change detecting process 2800 is started up (Process 2503). In starting up it, the message ID of the received message is given.

[0037] Next, the message value change detecting process 2800, which is part of the message value change detecting process 280, will be explained with reference to Fig. 4. The message value change detecting process 280 is started up from the periodic message receiving processes explained above.

[0038] The message value change detecting process 2800, when started up, first reads out the message stored in the period/event message buffer 202 to check whether or not the this-time-value of the received message is different from the last-time-value thereof (Process 2801). For example, if in Fig. 3 the ID of the message is 2, both are different since its this-time value is 20 and its last-time-value is 18. If the ID of the message is 6, both are the same since its this-time-value is 6400 and its last-time-value is also 6400. If the last-time-value and the this-time-value are different from each other, the event message sending process 270 is started up (Process 2802 whereas if the last-time-value and the this-time-value are the same, the processing is completed without any additional process.

[0039] Next, an event message sending process 2700, which is part of the event message sending process 270, will be explained by with reference to Fig. 5. The event message sending process 2700 is started up in a case where the value of the message fetched from the control system network is different from the last-time-value.

[0040] First, the event message sending process 2700 reads out the this-time-value of the message sent from the period/event message buffer 202 (Process 2701). For example, in Fig. 3, if the message having an ID of 2 is intended to be sent, the this-time-value 20 stored in the area 20221 is read out.

[0041] Next, by calling up the information system network communication process 230, the transmission of the message is effected (Process 2702). This can be executed by calling out Send Message ( ), as stated above in this embodiment, the messages are transmitted by using the same ID both in the control system network and in the information system network. Although different IDs can be used in the control system and the information system, in such case it is necessary to

memorize the correspondence between the ID used in the control system and the ID used in the information system.

[0042] Lastly, the this-time-value of the periodic event message buffer 202 is stored as the last-time-value (Process 2703). For example, in Fig. 3, in the case of the message having an ID of 2, the value which was stored in the area 20221 is stored in the area 20231.

[0043] The above-described explanation is directed to the operation for transferring a message from the control system network 20, which handles the periodic messages, to the information system network 30, which handles the event messages. An example of the operation for message transfer from the control system network 20 to the information system network 30 will be explained with reference to Fig. 6.

[0044] Fig. 6 shows, for the message having the ID of 2 in Fig. 3, the reception timing of the periodic message from the control system network 20, the transmission timing of the event message to the information system network 30, and the change of the storing area 20221 for the this-time-value of the message having the ID of 2 of the period/event message buffer. In the figure, the flow of time is represented downwardly.

[0045] Periodic messages are generated at a constant period and are received as messages 20251, 20252, 20253, 20254, 20255. Incidentally, in this case, it is supposed that before the periodic message 20251 is received, the this-time-value of the message is 15. The value of the periodic message 20251 is 15, the values of messages 20252, 20253 and 20254 are 18 and the value of message 20255 is 20. When the periodic message 20252 is received, the this-time-value changes from 15 to 18, and, at this time, the event message 20261 having a value of 18 is transferred. Also, when the

periodic message 20255 is received, the this-time-value changes from 18 to 20, and, at this time, the event-message 20262 having a value of 20 is transmitted.

[0046] As explained above, only that message for the control system network 20, which is received periodically, and which, at the time, has a value which is different from the value which was received the last time, is transferred to the information system network 30.

[0047] Next, message transfer from the information system network 30, which handles event messages, to the control system network 20, which handles periodic messages, will be explained. In this embodiment, it is presumed that all of the messages of the control system network 20 have the same sending period.

[0048] The event message receiving process 260 is executed as one task. This task is started up in response to the reception of a message on the information system network by means of the OS 210. Since on the information system network 30 the message is delivered in response to an event, this process (task) is also started up periodically in response to this event.

[0049] The f low of an event message receiving process 2600, which is part of the event message receiving process 260, will be explained with reference to Fig. 7. The event message receiving process 2600 first, reads out the received message fetched from the information system network 30 (Process 2601). This is executed by calling Out Receive Message ( ) of the information system network communicating process 230, as explained above.

[0050] Next, the message read out is stored in the event/period message buffer 201 (Process 2602). Now, the construction of the event/period message buffer 201 will be explained with reference to Fig. 8. The event/period message buffer 20l has a

message ID storing area 20110 and a value storing area 20120. Further, these areas are divided into storing areas per ID. That is, the ID storing area 20110 is comprised of an area 20111, an area 20112, an area 20113, etc. The value storing area 20120 is comprised of an area 20121, an area 20122, an area 20123, etc. In Fig. 8, for example, in the case of the message having the ID value of 1, the value of the message read out is stored in the area 20121. In the case of the message having the ID value of 5, the value of the message read out is stored in the area 20122.

[0051] Next, a periodic message sending process 2400, which is part of the periodic message sending process 240, will be explained with reference to Fig. 9. The periodic message sending process 2400 is started up periodically by the OS 210 in accordance with the transmission period of the message of the control system network. As mentioned above, in one embodiment of this invention, it is presumed that the transmission period of all of the messages of the control system network 20 is the same.

[0052] The periodic message sending process 2400 first reads out the value of the message to be delivered from the event/period message buffer 201 (Process 2401). Incidentally, all of the messages to be sent are managed with reference to their IDs. For example, in Fig. 8, in a case where the message having an ID of 1 has been registered as the message to be sent, the this-time-value 100 stored in the area 20121 is read out.

[0053] Thereafter, the control system network communicating process 220 is called out to effect the transmission of the message (Process 2402). This can be achieved by calling out Send Message ( ), as mentioned above. In this embodiment, the messages are transferred with the same ID in both the control system and the information system, as mentioned above. Although different IDs can be used in the control system

and the inf ormation system, in such case, it is necessary to memorize the correspondence between the ID used in the control system and the ID used in the information system.

[0054] The above-mentioned process 2401 and process 2402 are repeated until the processing of all messages is completed (Process 2403).

[0055] The above description is directed to the operation of transferring messages from the information system network 30, which handles the event messages, to the control system network 20, which handles the periodic messages. An example of the operation of transferring messages from the information system network 30 to the control system network 20 will be explained with reference to Fig. 10.

[0056] Fig. 10 shows, for the message having the ID of 1 in Fig. 7, the reception timing of the event message received from the information system network, the transmission timing of the periodic message to the control system network 20, and the change of the value in the storing area 20121 of the message having the ID of 1 in the event/period message buffer. In the figure, the downward flow of time indicates the passage of time.

[0057] The event messages are received as messages 20161, 20162 and 20163. The value of the event message 20161 is 80, the value of message 20162 is 90, and the value of message 20163 is 100. On the other hand, the periodic messages are generated at a constant period and are delivered as messages 20151, 20152, 20153, 20154 and 20155. As the value of the periodic message, the value in the storing area 20151 for the message value at the point of time of the delivery is used. Therefore, the values of the periodic messages 20151, 20152 and 20153 are 80, and the values of the periodic messages 20154 and 20155 are 100. Incidentally, after the periodic message 20153 has been delivered, although the value changes to 90 in response to the reception

of the event message 20162, this event message having the value of 90 is not delivered, since before the next periodic message is delivered, the value changes to 100 in response to the reception of the event message 20163.

[0058] As mentioned above, the messages of the information system network as received periodically in response to events are delivered to the control system network periodically.

[0059] An example of a distributed system for an automobile using the gateway of this embodiment is shown in Fig. 11. This distributed system is comprised of two networks, a control system network 20 and an information system network 30, which are connected through the gateway 10, as explained above.

[0060] To the control system network 20, there is connected the gateway 10, as well as an engine controlling unit 40 for controlling the automobile engine and an ACC (Adaptive Cruise Control) controlling unit 50 for performing automobile travelling control to maintain the distance between it and a preceding car constant. Between the engine controlling unit, the ACC controlling unit and the gateway, information is exchanged by way of periodic messages.

[0061] To the information system network 30, there is connected the gateway 10, as well as a navigation system 60 for performing course guidance and an internet terminal 70 for connecting to the internet to gather information. Between the navigation system, the internet terminal and the gateway, information is exchanged by way of event messages.

[0062] With such a system construction, it is possible to exchange information between the navigation system and the ACC unit or between the navigation system and the engine controlling unit. For example, it is possible to realize the function

of performing inter-car distance control within a range below the restricted speed by delivering course limited speed information from the navigation system to the ACC unit. Also, by delivering engine status information, such as engine speed or the like, from the engine controlling unit to the navigation system, it is possible to observe the engine status on the screen of the navigation system.

[0063] The foregoing detailed explanation was directed to one embodiment of this invention. In accordance with this invention, in a distributed system having an information system network and control system network within an automobile, a periodic message suitable for the exchange of information for control can be used in the control system network and an event message suitable for exchange of information for information processing can be used in the information system network, and the control system network and the information system network in the automobile can be connected effectively.

[0064] Also, in accordance with this invention, the periodic message receiving process is started up in response to a received event of a message on the control system network. With it, it is possible to start up the receiving process as soon as the periodic message received, and also to deliver the event message, immediately in response to a change of value. As a result, any time delay following the message transfer from the control system network to the information system network can be minimized.

[0065] Also, in accordance with the above-described embodiment of this invention, both the control system network and the information system network were configured using a DAM network. Thus, by using the same kind of network in both networks, it is possible to make the system construction simple. Also, in the hardware, it is possible to use a micro-controller which houses the CPU, the memory and two CAN

controllers, whereby the gateway can be installed compactly.

[0066] The control network 20 according to the above-described embodiment of this invention was constructed using a CAN network, but a network such as SAE/Jl850, TTP (Time-Triggered Protocol) or the like may be used. Also, in accordance with this invention, the CAN network was used in the information system network, but instead, a network such as D2B Optical, IDB (ITS DATA Bus), VAN (Vehicle Area Network) or the like may be used. It is possible to use different networks between the control system network and the information system network. Since these various networks can be used, it is possible to cope with a wider range of automobile systems. Also, by using a high speed network, it is possible to realize a system with high performance.

[0067] In the above-described embodiment of this invention, a network communication process according to the OSEK-COM specification was used in the control system network communicating process 220 and the information system network communicating process 230. However, it is possible to use a control system network communicating process or information system network communicating process according to a specification, such as IDB or the like. With this, it is possible to apply the invention to a wider range of automobile systems.

[0068] In the above-described embodiment of this invention, the transmission period of the control network was made constant regardless of the message, but it is possible to change the period per message. In this case, it is necessary to memorize in the memory 200 the correspondence between the ID and the transmission timing of the periodic message. The OS210 starts up the control system network communicating process 220 in conformity to the transmission timing of the periodic

message, and transfers the ID of the message to be sent. The control system network communicating process 220, on the basis of the ID transferred from the OS 210, reads out the message having that ID from the event/period message buffer, and performs the message transmitting process. Thus, it is possible to set up the most appropriate transmission period per message and to use the network effectively.

[0069] In the above-described embodiment of this invention, bi-directional message transfer was effected between the control system network and the information system network. However, it may be modified to one directional transfer from the control system network to the information system network or from the information system network to the control system network. Thus, the exchange of information is limited so as to improve the security.

[0070] In the above-described embodiment of this invention, the periodic message receiving process was started up in response to the reception of a message on the control system network. However, it may be started up at the same period as the periodic message.

[0071] Now, a case where the periodic message receiving process is started up at the same period as the periodic message will be explained. In this case, the correspondence between the message ID to be received and the startup timing of the periodic message receiving process and the correspondence between the message ID to be sent and the startup timing of the periodic message sending process are stored in the memory 200. The OS 210 manages the startup timing of the periodic message receiving process and the startup timing of the periodic message sending process, and starts the periodic message receiving process 250 and the periodic message sending process 240. Also, the OS 210, when starting up the periodic message sending process 240, delivers

the periodic message ID to be sent. In response thereto, the periodic message sending process shown in Fig. 9 is carried out, and the message corresponding to the delivered ID is transmitted. Also, the OS 210, when starting up the periodic message receiving process 250, delivers tire periodic message ID to be received. In response thereto, the periodic message receiving process shown in Fig.. 2 is executed, and the reception of the message corresponding to the delivered ID is performed.

[0072] Also, the periodic message receiving process may be performed as the same task as the periodic message sending process. By this, it is possible to make the task construction simple.

[0073] In the above-described embodiment of this invention, the OS was used and the task was started up under control of the OS. However, instead, it is possible to start up and execute, without the OS, the periodic message receiving process by interrupt from the control system network controller, the event message receiving process by interrupt from the information system network controller and the periodic message sending process by interrupt from a timer. Thus, the OS becomes unnecessary and a reduction of the cost can be achieved.

[0074] In the above-described embodiment of this invention, one control system network and one information system network were connected. Thus, the networks 20 and 30, the network controllers 400 and 600, and the network drivers 50 and 700 corresponding to the control system network and information system network, respectively, were provided. However, instead,, it is possible to connect a plurality of control system networks and a plurality of information system networks. To this end, it is necessary to provide a number of control system network controllers, a number of control system network drivers and the control system networks corresponding to the

number of the plurality of control system networks, respectively. Further, in the control system network communicating process 220, a function for performing allocation to this plurality of control system networks on the basis of the network IDs is provided. Also, the respective number of the information system network controllers, information system network drivers and information system networks correspond to the number of the plurality of information system networks, and a function is provided for performing allocation to these plurality of information system networks. In this way, it is possible to cope with a large-scale system.

[0075] In the control system according to the above-described embodiment of this invention, only the periodic message was used. However, instead, it is possible to use a mixture of event messages and periodic messages in the control system network. In this case, at the time of transfer from the control system network to the information system network, the periodic message is transferred after it is converted to an event message, as in the described embodiment of the invention, whereas the event message is transferred as it is. Also, in the case of transfer from the information system network to the control system network, there are methods for transforming an event message into a periodic message, as in the described embodiment of this invention, and for transferring it as it is. It is possible to properly use them depending upon the message. In this way, it is possible to use an event message also in the control system; and, in a case where information having lesser changes is exchanged, it is possible to reduce the load of the network.

[0076] In the information system network according to the above-described embodiment of this invention, only the event message was used. However, instead, it is possible to use a mixture of event messages and periodic messages in the

information system network. In this case, when the transfer from the information system network to the control system network is carried out, the event message is transferred after it is transformed into a periodic message, as in the case of the above-described embodiment of this invention, whereas the periodic message is transferred as it is. In the case of transfer from the control system network to the information system network, there are methods for transforming a periodic message into an event message, as in the above-described embodiment of this invention, and for transferring it as a periodic message. It is possible to properly use them depending upon the message. In this way, it is possible to use the periodic message also in the information system, and to improve real-time capacity as to multi-media information, such as an image, and audio.

[0077] In the above-described distributed system according to this invention, the control system network and the information system network were connected through a gateway which is a type of independent arrangement, but the gateway function may be incorporated within the controlling unit of the control system. An embodiment incorporating this feature is shown in Fig. 12. In this embodiment, there are a control system network 20 and an information system network 30. To the control system network 20, an engine controlling unit 40 and an ACC control unit 50 are connected. Also, to the information system network 30, the engine controlling unit 40 and a navigation system 60 are connected. In this embodiment, a gateway function 410 is incorporated within the engine controlling unit 40 to cause the engine controlling unit 40 to have a gateway function. The gateway function 410 can be realized in a similar way to the gateway in the previously described embodiment of this invention. In this way, there is no need to use an independent gateway, and therefore it is possible to reduce the cost.

[0078] In accordance with this embodiment of the invention, the function

of the gateway is realized by means ofsoftware, but it ispossible to achieve the same function by means of hardware. In this way, an effect can be obtained in that the system is speeded up.

[0079] In the above-described embodiment of this invention, the control system network for transmitting a periodic message and the information system network for transmitting an event message were connected, but with a network for transmitting a periodic message and a network for transmitting an event message, the invention is not limited to the use of a control system network and an information system network, respectively. For example, it is possible to provide a power train system control network using periodic messages and a body system control network using event messages, respectively. Also, the invention is not limited to use in an automobile. For example, a system having a network handling periodic messages and a network handling event messages is useful for many applications, such as an FA (Factory Automation) system, an electric power system, a railroad system, a steel producing system and the like. In this way, in a distributed system having various networks, a high efficiency gateway can be obtained.

[0080] This invention can be applied to such applications as industrial machinery, electric power systems, a railroad, steel production, an automobile or the like, in which a plurality of kinds of networks are interconnected.

# GATEWAY AND DISTRIBUTED SYSTEM USING THE GATEWAY

## TECHNICAL FIELD

This invention relates to a gateway for connecting a plurality of networks having different characters, and a distributed system using this gateway.

## BACKGROUND TECHNIQUE

In a recent automobile, various electronic apparatus are loaded including an audio instrument, a navigation device, an engine controlling device, a driving device for a mission etc., for example, and these electronic apparatuses are connected to networks depending upon their characters. To a network for an information system, an apparatus operating by an input (input of an event) from the outside, such as an audio instrument, and to a network for a control system, an apparatus for outputting information at a predetermined period, such as an engine controlling apparatus is connected.

Japanese Patent Application Laid-Open No.11-8647(1999) discloses a gateway for connecting between plural LANs which are different in protocol.

However, in such prior art publication, there is no description for a gateway connecting the networks which are different in character, one being so called information system network, and the other so called control system network, for example. Specifically, there is not disclosed in the above-mentioned publication, the transmission of information

between the information system network in which information is transmitted in response to an event and the control system network in which information is transmitted at a constant period.

## DISCLOSURE OF THE INVENTION

An object of this invention is to provide a gateway which can connect an information system network and a control system network and can perform information exchange between the information system network and the control system network, and to provide a distributed system using this gateway.

Characteristic features of this invention for obtaining the above-mentioned object are as follows. The object of this invention can be achieved by the individual or any combination of these characteristic features.

The gateway performs the send and receive of a message which is transmitted periodically, and the send and receive of a message which is transmitted in response to an event, or request or demand.

Also, the gateway, upon the detection of the change of a periodical message received from one network, sends a message to another network.

Also, the gateway periodically sends a message received from one network to another network.

## BRIEF EXPLANATION OF THE DRAWINGS

Fig. 1 is a diagram showing the construction of a gateway according to one embodiment of this invention;

Fig. 2 is a flow chart showing a periodical message receiving process according to one embodiment of this invention;

Fig. 3 is a diagram showing the construction of a period/event massage buffer according to one embodiment of this invention;

Fig. 4 is a flow chart showing a message value change detecting process according to one embodiment of this invention;

Fig. 5 is a flow chart showing an event massage sending process according to one embodiment of this invention;

Fig. 6 is a diagram showing one example of operation in a message transfer from a control system network to an information system network according to one embodiment of this invention;

Fig. 7 is a flow chart showing the flow of an event message receiving process according to one embodiment of this invention;

Fig. 8 is a diagram showing the construction of an event/period message buffer according to one embodiment of this invention;

Fig. 9 is a flow chart showing a periodical message sending process according to one embodiment of this invention;

Fig. 10 is a diagram showing one example of operation in a message transfer from an information system network to a control system network according to one embodiment of this invention;

Fig. 11 is a diagram showing the construction of a distributed system according to one embodiment of this invention;

Fig. 12 is a diagram showing the construction of a distributed system according to another embodiment of this invention.

BEST MODE FOR EMBODYING THE INVENTION

Hereinafter, embodiments of this invention will be explained in detail using attached drawings.

First of all, a first embodiment of this invention will be explained. This invention is intended to handle an event massage mode in which a message is output from a processing apparatus onto a network in response to the generation of an event, and a periodical message mode in which a message is output from the processing apparatus onto a network at a predetermined period, and it enables the exchange of messages between a network to which the processing apparatus which outputs the event message is connected (hereinafter, "an information system network" is referred to) and a network to which the processing apparatus which outputs the periodic message (hereinafter, "a control system network" is referred to).

Fig. 1 shows the construction of a gateway according to this invention. The gateway 10 is connected to the control system network 20 and the information system network 30. A CAN (Controller Area Network) is used for the control system network 20 and information system network 30 according to this embodiment.

The gateway 10 is comprised of a CPU 100, a memory 200, a bus 300, a control system network controller 400, a control system network driver 500, an information system network controller 600 and an information system network driver 700.

The CPU 100, the memory 200, the control system network

controller 400, the information system network controller 600 are connected to the bus 300 which is a signal line. The CPU 100 reads out the program stored in the memory 200, controlling the control system network controller 400, the control system network driver 500, the information system network controller 600 and the information system network driver 700, so that the exchange of the messages is performed between the information system network 20 and the control system network 30.

The control system network controller 400 is connected to the control system network driver 500 and the control system network driver 500 is connected to the control system network 20, so that the message transmission to the control system network 20 is carried out. The information system network controller 600 is connected to the information system network driver 700 and the information system network driver 700 is connected to the information system network 30, so that the message transmission to the information system network 30 is carried out.

The memory 200 has a program stored for running an OS (Operating System) and application programs stored for a control system network communicating process 220, an information system network communicating process 230, a periodical message sending process 240, a periodical message receiving process 250, an event massage receiving process 260, an event message sending process 270 and a message value change detecting process 280, and the memory 200 also has data storing areas such as an event/period message buffer 201 and a period/event message buffer 202.

As the OS 210 in this embodiment, the OSEK-OS described in OSEK/VDX Operating System Version 2.0 revision 1 (1997) published by OSEK/VDX is utilized. Thus, by using the OS, it is possible to cause the application programs to start up periodically as tasks, and the message on the network to start up by the received event.

Also, as the control system network communicating process 220, the OSEK-COM described in OSEK/VDX Communication Version 2.1 revision 1 (1998) published by OSEK/VDX is utilized. The OSEX-COM has its function effecting both of the massage sending process and the message receiving process. Also, it has a function of specifying a message for reception by ID attached thereto. Therefore, it is possible to specify a message to be received within the periodic messages on the control system network 20. In case where a message is transmitted to the control system network 20, by calling out Send Message () which is one API Service of the OSEK-COM from the application program for performing the periodic message sending process, it is possible to transmit the message onto the control system network 20 through the control system network controller 400. Also, in receiving the message from the control system network 20, the predetermined ID of the message to be received has been managed, and when the massages having the same ID are received the control system network controller 400 performs reception interrupt. In response to the reception interrupt from the control system network controller 400, an interrupt process for the message reception of the control system network communicating process

is started up, and it becomes possible to take the message on the control system network 20. The message fetched in can be read out by calling out Receive Message () which is one of the API Services of the OSEK-COM.

In this embodiment, the information system network communicating process 230 also uses the OSEK-COM. Therefore, also in case where the message is sent to the information system network 30, an application program for performing the transmission process of the event message is executed by calling out therefrom Send Message () which is one of the API Services of the OSEK-COM, the message can be sent onto the information system network 30 through the information system network controller 600. Also, in receiving the message from the information system network 30, the predetermined ID of the message to be received has been managed, and when the massages having the same ID are received the information system network controller 600 performs reception interrupt. In response to the reception interrupt from the information system network controller 600, an interrupt process for the message reception of the information system network communicating process is started up, and it becomes possible to take the message on the information system network 30. The message fetched in can be read out by calling out Receive Message () which is one of the API Services of the OSEK-COM.

Next, the operation of the gateway 10 according to this embodiment will be explained. First, the case where a message is transferred from the control system network 20 handling the

periodical message to the information system network 30 handling the event message will be explained.

As stated above, when the control system network controller 400 receives a message having a predetermined ID from among a plurality of periodical messages on the control system network, it perform an interruption. In response thereto, the OS 210 starts up the program of the periodical message receiving process 250. This program of the periodical message receiving process 250 is executed as one task. Since on the control system network 20 the massage is transmitted periodically, this process (task) is also started up periodically.

The processing flow of a periodical message receiving Process 2500 which is the process of the periodical message receiving process 250 will be explained using Fig. 2. First, the periodical message receiving Process 2500 reads out a received message which was taken from the control system network 20 (Process 2501). This is executed by calling out Receive Message () of the control system network communicating process 220, as mentioned above.

Next, the message read out is stored in the period/event message buffer 202 (Process 2502). Now, the construction of the period/event message buffer 202 will be explained using Fig. 3. As explained above, a message has ID (identifier) attached thereto. The period/event message buffer 202 includes a message ID storing area 20210, a this-time-value (value of the most recent message) storing area 20220 and a last-time-value (value of the message received most previously after the most recent message)

storing area 20230. Further, these areas are divided into storing areas per ID. That is, the ID storing area 20210 comprises an area 20211, an area 20212, an area 20213, etc. The this-time-value storing area 20220 comprises an area 20221, an area 20222, an area 20223, etc. per respective ID. The last-time-value storing area 20230 also comprises an area 20231, an area 20232, an area 20233, etc. per ID. For example, the message of ID2 is stored so that the value (2) of its ID is memorized in the area 20211, the this-time-value (20) is memorized in the area 20221 and the last-time-value (18) is memorized in the area 20231.

In Process 2502, the value of the message read out is stored in the storing area of the this-time-value corresponding to the ID of this message. For example, in the case of the message of which ID is 2, the value of the message read out is stored in the area 20221. In the case of the message having ID of 6, the value of the message read out is stored in the area 20222.

Lastly, a message value change detecting process 2800 is started up (Process 2503). In starting up it, the message ID of the received message is given.

Next, the message value change detecting process 2800 which is the process of the message value change detecting process 280 will be explained using Fig. 4. The message value change detecting process 280 is started up from the periodic message receiving process, as explained above.

The message value change detecting process 2800, when started up, first reads out the message stored in the period/event

message buffer 202 to check whether or not the this-time-value of the received message is deferent from the last-time-value thereof (Process 2801). For example, if in Fig. 3 the ID of the message is 2, both are different since its this-time value is 20 and its last-time-value is 18. If the ID of the message is 6, both are the same since its this-time-value is 6400 and its last-time-value is also 6400.

If the last-time-value and the this-time-value are different from each other, the event message sending process 270 is started up (Process 2802), whereas if the last-time-value and the this-time-value are the same, the processing is completed without any additional process.

Next, an event message sending process 2700 which is the program of the event message sending process 270 will be explained by using Fig. 5. The event message sending process 2700 is started up in case where the value of the message fetched from the control system network is different from the last-time-value.

First, the event message sending process 2700 reads out the this-time-value of the message sent from the period/event message buffer 202 (Process 2701). For example, in Fig. 3 if the message having its ID of 2 is intended to be sent, the this-tame-value 20 stored in the area 20221 is read out.

Next, by calling up the information system network communication process 230, the transmission of the message is effected (Process 2702). This can be executed by calling out Send Message (), as stated above. In this embodiment, the messages are transmitted by using the same ID both in the control

system network and in the information system network. Although different IDs can be used in both of the control system and the information system, in this case it is needed to memorize the correspondence between the ID used in the control system and the ID used in the information system.

Lastly, the this-time-value of the periodical event message buffer 202 is stored as the last-time-value (Process 2703). For example, in Fig. 3, in the case of the message having the ID of 2, the value which was stored in the area 20221 is stored in the area 20231.

The above-described explanation is the operation for transferring the message from the control system network 20 handling the periodic message to the information system network 30 handling the event message.

An example of operation for message transfer from the control system network 20 to the information system network 30 will be explained using Fig. 6. Fig. 6 shows that for the message having the ID of 2 in Fig. 3 the reception timing of the periodical message from the control system network 20, the transmission timing of the event message to the information system network 30, and the change of the storing area 20221 for the this-time-value of the message having the ID of 2 of the period/event message buffer. The figure shows the flow of time downwardly.

The periodical message is at a constant period, and received in the way of 20251, 20252, 20253, 20254, 20255. Incidentally, in this case, it is supposed that before the

periodic message 20251 is received, the this-time-value of the message is 15. The value of the periodical message 20251 is 15, the values of 20252, 20253 and 20254 are 18 and the value of 20255 is 20. When the periodical message 20252 is received, the this-time-value changes from 15 to 18, and at this timing the event message 20261 having its value of 18 is transferred. Also, when the periodical message 20255 is received, the this-time-value changes from 18 to 20, and at this timing the event message 20262 having its value of 20 is transmitted.

As explained above, the message for the control system network 20 which is received periodically, only at the time when its value is different from the value which was received at the last time, is transferred to the information system network 30.

Next, message transfer from the information system network 30 handling the event message to the control system network 20 handling the periodical message will be explained. In this embodiment, it is supposed that all of the messages of the control system network 20 are the same in sending period.

The event message receiving process 260 is executed as one task. This task is started up in response to the reception event of the message on the information system network by means of the OS 210. Since on the information system network 30 the message is delivered in response to an event, this process (task) is also started up periodically in response to this event.

The flow of an event message receiving process 2600 which is the process of the event message receiving process 260 will be explained using Fig. 7. The event message receiving process

2600 first reads out the received message fetched from the information system network 30 (Process 2601). This is executed by calling out Receive Message () of the information system network communicating process 230, as explained above.

Next, the message read out is stored in the event/period message buffer 201 (Process 2602). Now, the construction of the event/period message buffer 201 will be explained using Fig. 8. The event/period message buffer 201 has a message ID storing area 20110 and a value storing area 20120. Further, these areas are divided into storing areas per ID. That is, the ID storing area 20110 is comprised of an area 20111, an area 20112, an area 20113, etc. The value storing area 20120 is comprised of an area 20121, an area 20122, an area 20123, etc. In Fig. 8, for example, in the case of the message having the ID value of 1, the value of the message read out is stored in the area 20121. In the case of the message having the ID value of 5, the value of the message read out is stored in the area 20122.

Next, a periodical message sending process 240 which is the process of the periodical message sending process 240 will be explained by using Fig. 9. The periodical message sending process 240 is started up periodically by the OS 210 in accordance with the transmission period of the message of the control system network. As mentioned above, in one embodiment of this invention, it is supposed that the transmission period of all of the messages of the control system network 20 is the same.

The periodical message sending process 2400 first reads out the value of the message to be delivered from the event/period

message buffer 201 (Process 2401). Incidentally, all of the messages to be sent are administrated with their IDs. For example, in Fig. 8, in case where the message having its ID of 1 has been registered as the message to be sent, the this-time-value 100 stored in the area 20121 is read out.

Thereafter, the control system network communicating process 220 is called out to perform the transmission of the message (Process 2402). This can be achieved by calling out Send Message () as mentioned above. In this embodiment, the messages are transferred with the same ID in both of the control system and the information system, as mentioned above. Although different IDs can be used in the control system and the information system, in this case it is needed to memorize the correspondence between the ID used in the control system and the ID used in the information system.

The above-mentioned process 2401 and process 2402 are repeated until the processes for all messages are completed (Process 2403).

The above is the message transferring operation from the information system network 30 handling the event message to the control system network 20 handling the periodic message.

An example of the transferring operation from the information system network 30 to the control system network 20 will be explained using Fig. 10. Fig. 10 shows, for the message having the ID of 1 in Fig. 7, the reception timing of the event message from the information system network, the transmission timing of the periodical message to the control system network

20, and the change of the storing area 20121 in the value of the message having the ID of 1 in the event/period message buffer. In the figure, the downward flow of time indicates the passage of time.

The event messages are received in the way of 20161, 20162 and 20163. The value of the event message 20161 is 80, the values of 20162 is 90, and the value of 20163 is 100. On the other hand, the periodical messages are at a constant period, and are delivered in the way of 20151, 20152, 20153, 20154 and 20155. As the value of the periodical message, the value in the storing area 20151 for the message value at the point of time of the delivery is used. Therefore, the values of the periodical messages 20151, 20152 and 20153 are 80, and the values of the periodic messages 20154 and 20155 are 100.

Incidentally, although after the periodical message 20153 was delivered, the value changes to 90 by the reception of the event message 20162, this event message having the value of 90 is not delivered since before the next periodic message is delivered the value changes to 100 by the reception of the event message 20163.

As mentioned above, the messages of the information system network as received periodically in response to events are delivered to the control system network periodically.

An example of a distributed system for an automobile using the gateway of this embodiment is shown in Fig. 11. This distributed system has two networks, a control system network 20 and an information system network 30, which are connected

through the gateway 10 as explained above.

To the control system network 20 the gateway 10 as well as an engine controlling unit 40 for controlling an engine and an ACC (Adaptive Cruise Control) controlling unit 50 for performing automobile travelling control to maintain the distance between a preceding car constant, are connected. Between the engine controlling unit, the ACC controlling unit and the gateway the information is exchanged by the periodical messages.

To the information system network 30 the gateway 10 as well as a navigation system 60 for performing course guidance and an internet terminal 70 for connecting to the internet to gather information are connected. Between the navigation system, the internet terminal and the gateway the information is exchanged by the event massages.

With such system construction, it is possible to exchange the information between the navigation system and the ACC unit or between the navigation system and the engine controlling unit. For example, it is possible to realize the function of performing inter-car distance control within the range below the restricted speed by delivering course limited speed information from the navigation system to the ACC unit. Also, by delivering engine status information such as engine speed or the like from the engine controlling unit to the navigation system it is possible to observe the engine status on the screen of the navigation system.

The above was the detailed explanation as to one embodiment

of this invention.

In accordance with one embodiment of this invention, in the distributed system having the information system network and control system network within an automobile there exists the effect that a periodical message suitable to exchange the information for control can be used in the control system network and an event massage suitable to exchange the information for information processing can be used in the information system network, and that the control system network and the information system network in the automobile can be connected effectively.

Also, in accordance with one embodiment of this invention, the periodic message receiving process was started up in response to the received event of the message on the control system network. With it, it is possible to start up the receiving process as soon as the periodic massage reaches, and also to deliver the event message immediately upon the change of value. by this, the effect is provided that any time delay following the message transfer from the control system network to the information system network can be minimized.

Also, in accordance with one embodiment of this application, both of the control system network and the information system network was arranged by using the DAM network. Thus, by using the same kind of network in both networks, the effect that it is possible to make the system construction simple is provided, Also, there exists the effect that in the hardware it is possible to use a micro-controller which houses the CPU, the memory and two CAN controllers, and whereby the gateway can be installed

compactly.

The control network 20 according to one embodiment of this invention was constructed using the CAN, but a network such as SAE/J1850, TTP (Time-Triggered Protocol) or the like may be used. Also, in one embodiment of this invention, the CAN was used in the information system network, but instead a network such as D2B Optical, IDB (ITS DATA Bus), VAN (Vehicle Area Network) or the like may be used. It is possible to use different networks between the control system network and the information system network. Since these various networks can be used, the effect is provided that it is possible to cope with a wider range of automobile systems. Also, there exists the effect that by using a high speed network it is possible to realize a system with high performance.

In one embodiment of this invention, the network communication process according to the OSEK-COM specification was used in the control system network communicating process 220 and the information system network communicating process 230. However, it is possible to use a control system network communicating process or information system network communicating process according to a specification such as IDB or the like. With this, the effect is provided that it is possible to apply it to a wider range of automobile systems.

In one embodiment of this invention, the transmission period of the control network was made constant regardless of the message, but it is possible to change the period per message. In this case, it is needed to memorize in the memory 200 the

correspondence between the ID and the transmission timing of the periodical message. The OS 210 starts up the control system network communicating process 220 in conformity to the transmission timing of the periodical message, and transfers the ID of the message to be sent. The control system network communicating process 220, on the basis of the ID transferred from the OS 210, reads out the message of which ID agrees from the event/period message buffer, and performs the message transmitting process. Thus, the effect is provided that it is possible to set up the most appropriate transmission period per message and to use the network effectively.

In said one embodiment of this invention, the bi-directional message transfer was made between the control system network and the information system network. However, it may be modified to one directional transfer from the control system network to the information system network or from the information system network to the control system network. Thus, the effect is given that the exchange of information is limited so as thereby to improve security.

In said one embodiment of this invention, the periodical message receiving process was started up in response to the reception event of the message on the control system network. However, it may be started up at the same period as the periodical message.

Now, the case where the periodical message receiving process is started up at the same period, as the periodical message will be explained. In this case, the correspondence between

the message ID to be received and the startup timing of the periodical message receiving process and the correspondence between the message ID to be sent and the startup timing of the periodical message sending process are stored in the memory 200. The OS 210 manages the startup timing of the periodical message receiving process and the startup timing of the periodical message sending process, and starts the periodical message receiving process 250 and the periodical message sending process 240. Also, the OS 210, when starting up the periodical message sending process 240, delivers the periodical message ID to be sent. In response thereto, the periodical message sending process shown in Fig. 9 is carried out, and the message corresponding to the delivered ID is transmitted. Also, the OS 210, when starting up the periodical message receiving process 250, delivers the periodical message ID to be received. In response thereto, the periodical message receiving process shown in Fig. 2 is executed, and the reception of the message corresponding to the delivered ID is performed.

Also, the periodic message receiving process may be performed as the same task as the periodical message sending process. By this, the effect is provided that it is possible to make the task construction simple.

In said one embodiment of this invention, the OS was used and the task was started up by the function of the OS. However, instead it is possible to start up and execute, without the OS, the periodical message receiving process by interrupt from the control system network controller, the event message receiving

process by interrupt from the information system network controller and the periodical message sending process by interrupt from a timer. Thus, the effect is provided that the OS becomes unnecessary and the reduction of cost can be achieved.

In said one embodiment of this invention, one control system network and one information system network were connected. So, the networks 20 and 30, the network controllers 400 and 600, and the network drivers 50 and 700 corresponding to the control system network and information system network, respectively, were provided. However, instead, it is possible to connect a plurality of control system networks and a plurality of information system networks. To this end, it is needed to provide the control system network controllers, the control system network drivers and the control system networks corresponding to the number of the plurality of control system networks, respectively. Further, in the control system network communicating process 220 a function for performing allocation to this plurality of control system networks on the basis of the network IDs is provided. Also, the information system network controllers, the information system network drivers and the information system networks, the respective numbers corresponding to the number of the plurality of information system networks are provided, and a function is provided for performing allocation to these plurality of information system networks. By this, the effect is provided that it can cope with a large-scale system.

In said control system according to one embodiment of this

invention, only the periodical message was used. However, instead, it is possible to use mixed event massage and periodical message in the control system network. In this case, at the time of the transfer from the control system network to the information system network, the periodical message is transferred after it was converted to the event message as in the one embodiment of the invention, whereas the event message is transfer as it is. Also, in the case of the transfer from the information system network to the control system network, there are the methods for transforming the event message into the periodical message as in the one embodiment of this invention, and for transferring it as it is. It is possible to properly use them depending upon the message. By this, the effect is provided that it is possible to use the event massage also in the control system, and in case where information having lesser changes is exchanged, it is possible to reduce the load of the network.

In the information system network according to said one embodiment of this invention, only the event message was used. However, instead, it is possible to use mixed event massage and periodical message in the information system network. In this case, when the transfer from the information system network to the control system network is carried out, the event message is transferred after is was transformed into the periodical message as in the case of the one embodiment of this invention, whereas the periodical message is trans as it is. In the case of the transfer from control system network to the information

system network, there are the methods for transforming the periodical message into the event message as in the one embodiment of this invention, and for transferring it as the periodical message is. It is possible to properly use them depending upon the message. By this, the effect is provided that it is possible to use the periodical message also in the information system, and to improve real-time capacity as to multi-media information such as an image, and an audio.

In the distributed system according to said one embodiment of this invention, the control system network and the information system network were connected through the gateway which is of the type of an independent arrangement, but the gateway function may be incorporated within the controlling unit of the control system. An embodiment for this is shown in Fig. 12. In this embodiment, there are a control system network 20 and an information system network 30. To the control system network 20, an engine controlling unit 40 and an ACC control unit 50 are connected. Also, to the information system network 30, the engine controlling unit 40 and a navigation system 60 are connected. In this embodiment, a gateway function 410 is placed within the engine controlling unit 40, to cause the engine controlling unit 40 to have the gateway function. The gateway function 410 can be realized in the similar way to the gateway in one embodiment of this invention. By this, the effect is provided that there is no need to use an independent gateway, and therefore it is possible to reduce the cost.

In said one embodiment of this invention, the function

of the gateway was realized by means of software, but it is possible to achieve the same function by means of hardware. By this, the effect can be obtained that the system is speeded up.

In said one embodiment of this invention, the control system network for transmitting the periodical message and the information system network for transmitting the event message were connected, but with a network for transmitting the periodical message and a network for transmitting the event message, they are not limited to the control system network and the information system network, respectively. For example, they may be a power train system control network using the periodic message and a body system control network using the event message, respectively. Also, they are not limited to the use in an automobile. For example, in the network handling the periodical message and the network handling the event message they are applicable to many systems such as an FA (Factory Automation) system, an electric power system, a railroad system, a steel system and the like. By this, there occurs the effect that in a distributed system having various networks a high efficiency gateway can be obtained.

## INDUSTRIAL APPLICABILITY

This invention can be applied to a field such as industrial machinery, an electric power, a railroad, steel, an automobile or the like in which a plurality of kinds of networks are interconnected.

CLAIMS

1. A gateway comprising: periodical message receiving means for receiving a periodic message delivered periodically onto one network for reading in data; memory means for storing the data of said periodic message; message value change detecting means for detecting the change of the value of the data stored in said memory means; and event message sending means for delivering the data stored in said memory means as a message on another network when said message value change detecting means detects a change of the value of the data.

2. A gateway comprising: event massage receiving means for receiving an event massage delivered onto one network in response to an event or demand for reading in data; memory means for storing the data of said event massage; and periodical message sending means for delivering periodically the data stored in said memory means as a message on a different network.

3. A distributed system comprising:

a first network to which at least one device for performing periodically the sending or receiving of a message is connected;

a second network to which at least one device for performing the sending or receiving of a message in response to an event or demand; and

a gateway connected to said first and second networks, said gateway having periodical message receiving means for receiving messages which said first network sends periodically, memory

means for storing the message received by said periodical message receiving means, message value change detecting means for detecting the change of the value of the data included in the message stored in said memory means, and event message sending means for producing a message from the data stored in said memory means when said message value change detecting means detects a change of the value of the data, and for delivering the produced message to said second network.

4. A distributed system as claimed in claim 3, wherein said device for performing periodically the sending or receiving messages is an engine controlling device or an ACC control unit, and said device for performing the sending or receiving of messages in response to an event or demand is an navigation system or an internet terminal.

5. A distributed system comprising:

a first network on which a message generated at a predetermined time interval resides;

s second network on which a message generated in response to an event or demand resides; and

a gateway connected to said first and second network and having a memory part and a processing part;

said processing part of said gateway causing to memorize in said memory part the message generated by said first network at a predetermined time interval, detecting a change of the value of the data included in said memorized message, producing a

message from the data memorized in said memory part when a change of the value of the data is detected, and delivering said produced message to said second network.

6. A distributed system as claimed in claim 5, wherein said processing part causes to memorize in said memory part the message generated in response to an event or demand from said second network, and delivers said memorized message to said first network at a predetermined time interval.

ABSTRACT

A gateway by which a network for performing communication periodically and a network for performing communication to an event driven can be effectively connected and a distributed system are provided.

The gateway connecting different networks receives a periodical message, and when a change of the received message is detected sends it as an event message, and delivers the message periodically.

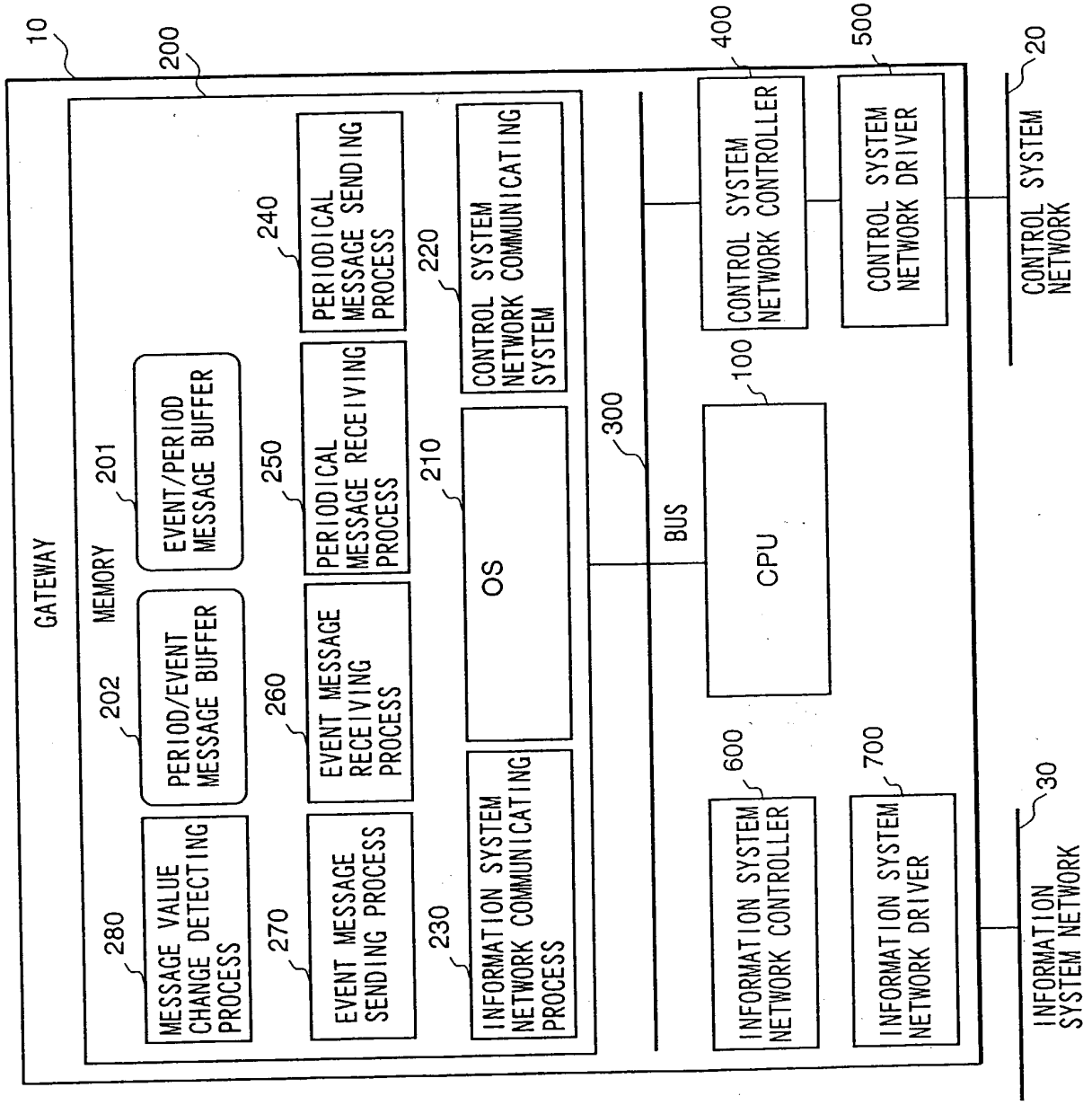

10
GATEWAY
200
MEMORY
201
EVENT/PERIOD MESSAGE BUFFER
202
PERIOD/EVENT MESSAGE BUFFER
240
PERIODICAL MESSAGE SENDING PROCESS
250
PERIODICAL MESSAGE RECEIVING PROCESS
260
EVENT MESSAGE RECEIVING PROCESS
270
EVENT MESSAGE SENDING PROCESS
280
MESSAGE VALUE CHANGE DETECTING PROCESS
210
OS
220
CONTROL SYSTEM NETWORK COMMUNICATING SYSTEM
230
INFORMATION SYSTEM NETWORK COMMUNICATING PROCESS
300
BUS
100
CPU
400
CONTROL SYSTEM NETWORK CONTROLLER
500
CONTROL SYSTEM NETWORK DRIVER
20
CONTROL SYSTEM NETWORK
600
INFORMATION SYSTEM NETWORK CONTROLLER
700
INFORMATION SYSTEM NETWORK DRIVER
30
INFORMATION SYSTEM NETWORK

FIG. 1

FIG. 2

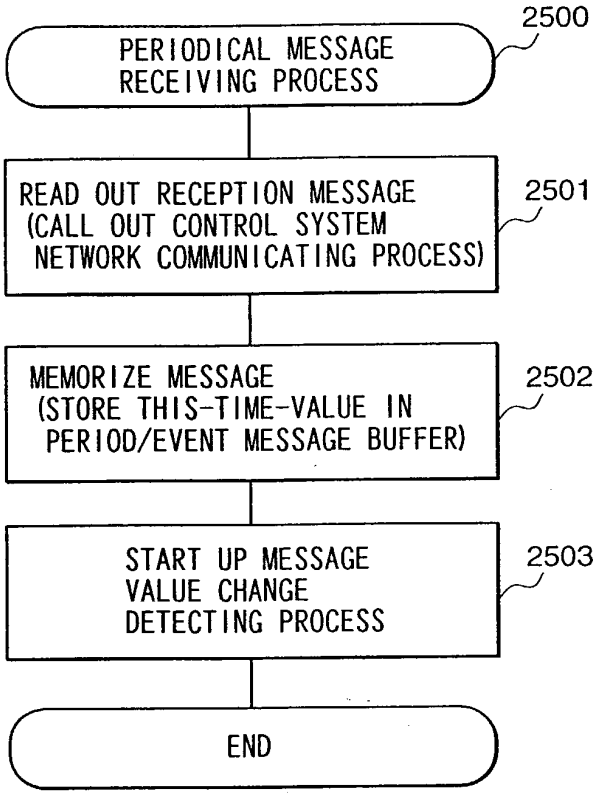

PERIODICAL MESSAGE RECEIVING PROCESS
2500
READ OUT RECEPTION MESSAGE (CALL OUT CONTROL SYSTEM NETWORK COMMUNICATING PROCESS)
2501
MEMORIZE MESSAGE (STORE THIS-TIME-VALUE IN PERIOD/EVENT MESSAGE BUFFER)
2502
START UP MESSAGE VALUE CHANGE DETECTING PROCESS
2503
END

FIG. 3

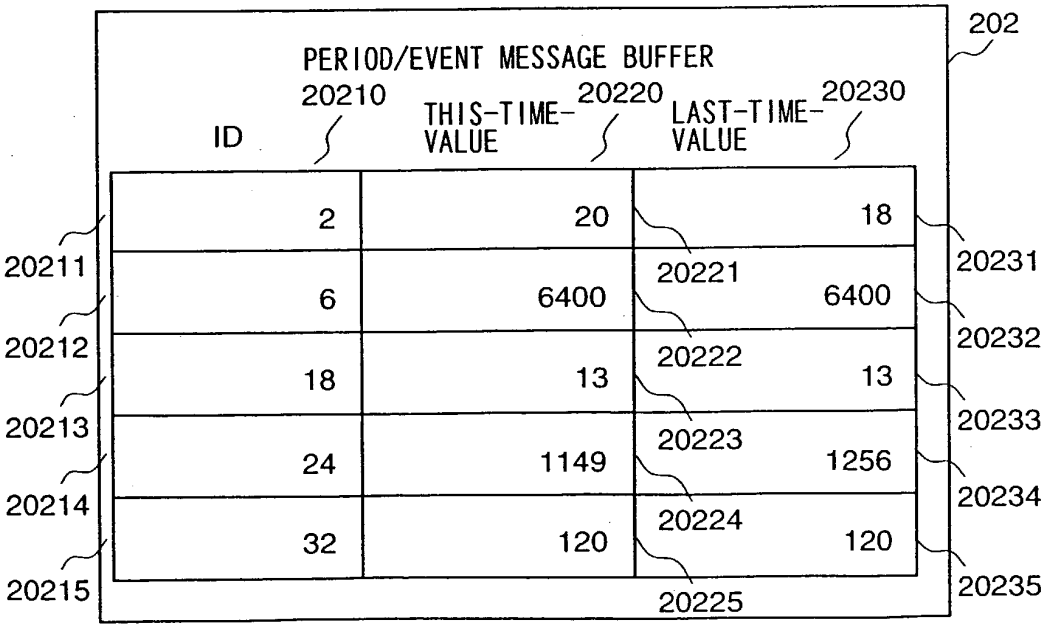

202
PERIOD/EVENT MESSAGE BUFFER
ID
20210
THIS-TIME-VALUE
20220
LAST-TIME-VALUE
20230
2
20
18
20211
20231
6
6400
20221
6400
20212
20232
18
13
20222
13
20213
20233
24
1149
20223
1256
20214
20234
32
120
20224
120
20215
20235
20225

FIG. 4

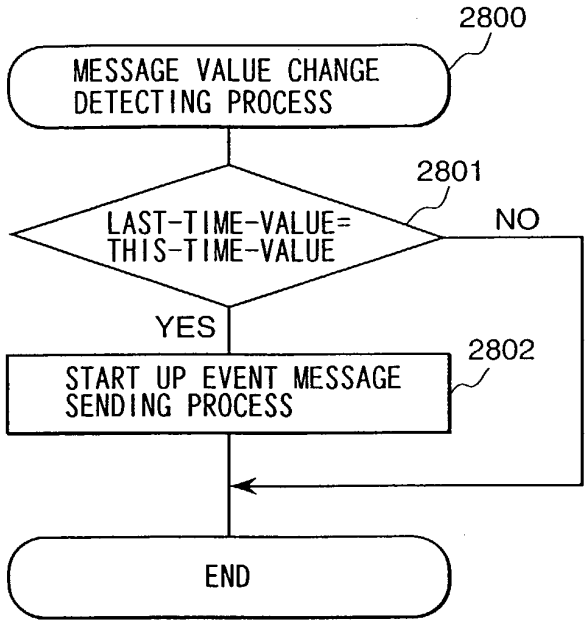

2800
MESSAGE VALUE CHANGE DETECTING PROCESS
2801
LAST-TIME-VALUE= THIS-TIME-VALUE
NO
YES
2802
START UP EVENT MESSAGE SENDING PROCESS
END

FIG. 5

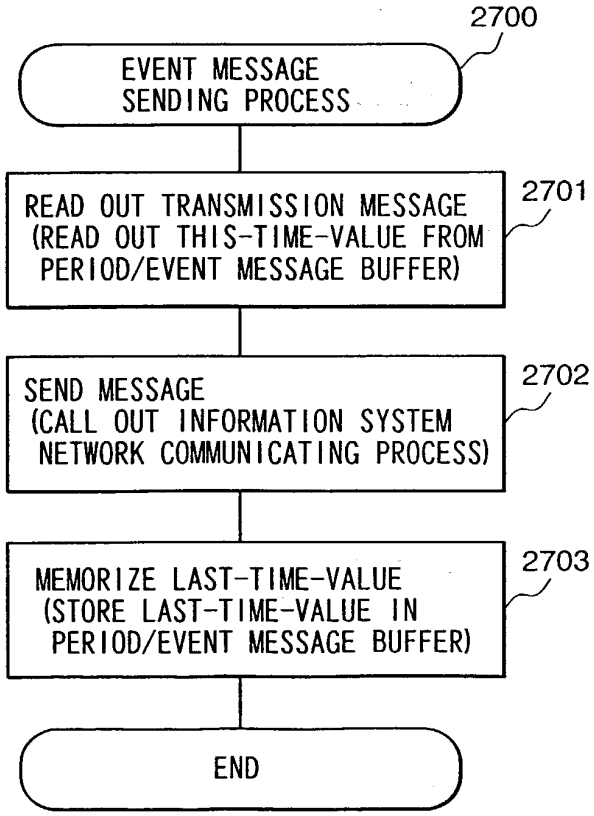

2700
EVENT MESSAGE SENDING PROCESS
READ OUT TRANSMISSION MESSAGE (READ OUT THIS-TIME-VALUE FROM PERIOD/EVENT MESSAGE BUFFER)
2701
SEND MESSAGE (CALL OUT INFORMATION SYSTEM NETWORK COMMUNICATING PROCESS)
2702
MEMORIZE LAST-TIME-VALUE (STORE LAST-TIME-VALUE IN PERIOD/EVENT MESSAGE BUFFER)
2703
END

FIG. 6

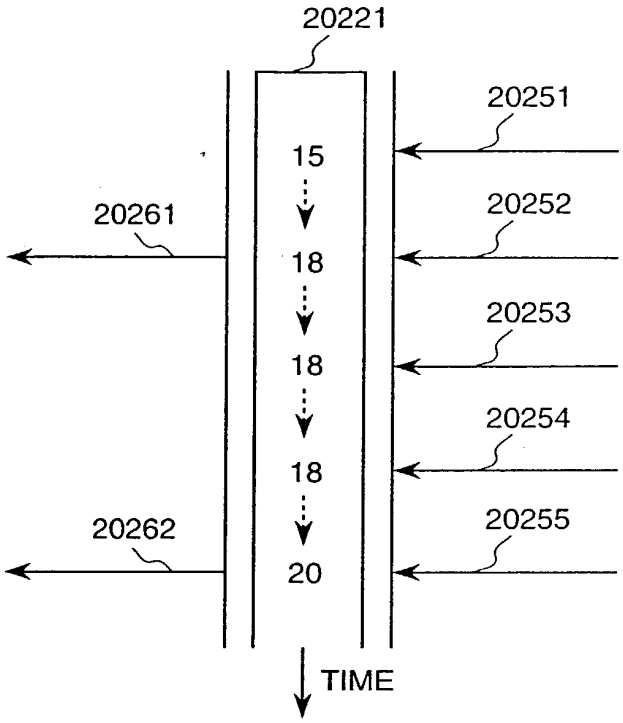
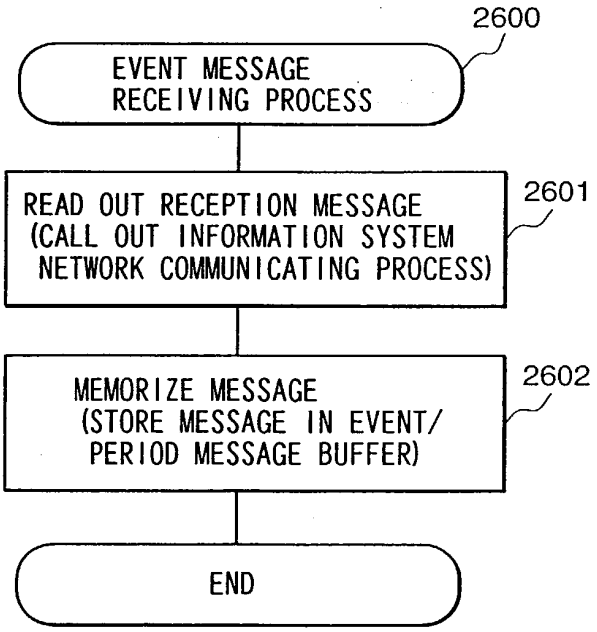

20221
20251
15
20261
20252
18
20253
18
20254
18
20262
20255
20
TIME

FIG. 7


2600
EVENT MESSAGE RECEIVING PROCESS
READ OUT RECEPTION MESSAGE (CALL OUT INFORMATION SYSTEM NETWORK COMMUNICATING PROCESS)
2601
MEMORIZE MESSAGE (STORE MESSAGE IN EVENT/ PERIOD MESSAGE BUFFER)
2602
END

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# Declaration and Power of Attorney For Patent Application

## 特許出願宣言書及び委任状

## Japanese Language Declaration

## 日本語宣言書

下記の氏名の発明者として、私は以下の通り宣言します。

As a below named inventor, I hereby declare that:

私の住所、私書箱、国籍は下記の私の氏名の後に記載された通りです。

My residence, post office address and citizenship are as stated next to my name.

下記の名称の発明に関して請求範囲に記載され、特許出願している発明内容について、私が最初かつ唯一の発明者（下記の氏名が一つの場合）もしくは最初かつ共同発明者であると（下記の名称が複数の場合）信じています。

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

GATEWAY AND DISTRIBUTED SYSTEM USING THE GATEWAY

上記発明の明細書（下記の欄で×印がついていない場合は、本書に添付）は、

The specification of which is attached hereto unless the following box is checked:

☐ __月__日に提出され、米国出願番号または特許協定条約国際出願番号を_____とし、
(該当する場合) _____に訂正されました。

☒ was filed on December 15, 1999
as United States Application Number or
PCT International Application Number
PCT/JP99/07042 and was amended on
_____ (if applicable).

私は、特許請求範囲を含む上記訂正後の明細書を検討し、内容を理解していることをここに表明します。

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

私は、連邦規則法典第３７編第１条５６項に定義されるとおり、特許資格の有無について重要な情報を開示する義務があることを認めます。

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

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# Japanese Language Declaration
# (日本語宣言書)

委任状： 私は下記の発明者として、本出願に関する一切の手続きを米特許商標局に対して遂行する弁理士または代理人として、下記の者を指名いたします。（弁護士、または代理人の氏名及び登録番号を明記のこと）

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith (list name and registration number)

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| 唯一または第一発明者 | Full name of sole or first inventor<br>Takanori YOKOYAMA |
| 発明者の署名 日付 | Inventor's signature Date<br>Takanori Yokoyama 2/14/2001 |
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(第二以降の共同発明者についても同様に記載し、署名をすること)

(Supply similar information and signature for second and subsequent joint inventors.)

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# Japanese Language Declaration
# (日本語宣言書)

私は、米国法典第３５編１１９条 (a) - (d) 項又は３６５条 (b) 項に基き下記の、米国以外の国の少なくとも一カ国を指定している特許協力条約３６５ (a) 項に基ずく国際出願、又は外国での特許出願もしくは発明者証の出願についての外国優先権をここに主張するとともに、優先権を主張している、本出願の前に出願された特許または発明者証の外国出願を以下に、枠内をマークすることで、示している。

I hereby claim foreign priority under Title 35, United States Code, Section 119 (a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)
外国での先行出願

Priority Not Claimed
優先権主張なし

| (Number) (番号) | (Country) (国名) | (Day/Month/Year Filed) (出願年月日) | ☐ |
|---|---|---|---|
| (Number) (番号) | (Country) (国名) | (Day/Month/Year Filed) (出願年月日) | ☐ |

私は、第３５編米国法典１１９条 (e) 項に基いて下記の米国特許出願規定に記載された権利をここに主張いたします。

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below.

| (Application No.) (出願番号) | (Filing Date) (出願日) | (Application No.) (出願番号) | (Filing Date) (出願日) |
|---|---|---|---|

私は、下記の米国法典第３５編１２０条に基いて下記の米国特許出願に記載された権利、又は米国を指定している特許協力条約３６５条 (c) に基ずく権利をここに主張します。また、本出願の各請求範囲の内容が米国法典第３５編１１２条第１項又は特許協力条約で規定された方法で先行する米国特許出願に開示されていない限り、その先行米国出願書提出日以降で本出願書の日本国内または特許協力条約国際提出日までの期間中に入手された、連邦規則法典第３７編１条５６項で定義された特許資格の有無に関する重要な情報について開示義務があることを認識しています。

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| (Application No.) (出願番号) | (Filing Date) (出願日) | (Status: Patented, Pending, Abandoned) (現況：特許許可済、係属中、放棄済) |
|---|---|---|
| (Application No.) (出願番号) | (Filing Date) (出願日) | (Status: Patented, Pending, Abandoned) (現況：特許許可済、係属中、放棄済) |

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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| | | | |
|---|---|---|---|
| 第二共同発明者 | | 2-(2) Full name of second joint inventor, if any<br>Wataru NAGAURA | |
| 第二共同発明者の署名 | 日付 | Second inventor's signature<br>Wataru Nagaura | Date<br>2/14/2001 |
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| 第五共同発明者の署名 | 日付 | Fifth inventor's signature | Date |
| 住所 | | Residence | |
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(第六以降の共同発明者についても同様に記載し、署名をすること)

(Supply similar information and signature for sixth and subsequent joint inventors.)